Eimac

TUBES

EITEL-McC[illegible]UGH, INC.
SAN BRUNO, CALIFORNIA

triodes ▸

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- Your nearest Eimac Field Engineer, who stands ready to give you immediate engineering assistance, information on deliveries and prices, or provide other information not found in the catalog.
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- Tube Replacement Chart.
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Application Engineering. The Eimac Application Engineering Department is available at all times for consultation. New tube operating techniques are continually being explored, tested and proved by Eimac engineers, whose combined knowledge and experience are at your service. Additional contributions by this Eimac department are its Application Bulletins, a service which you receive without obligation.

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EITEL-McCULLOUGH, INC.
SAN CARLOS, CALIFORNIA

2C39A

HIGH-MU UHF TRIODE

▶

The Eimac 2C39A is a ceramic-metal high-mu planar triode with a plate-dissipation rating of 100 watts, designed for use as a power amplifier, oscillator, or frequency multiplier at frequencies to above 2500 megacycles. The new ceramic-metal construction results in extreme ruggedness, mechanical uniformity, reliable operation at seal temperatures up to 250°C, and longer life expectancy than its glass prototypes.

The 2C39A in a class-C r-f grounded grid circuit at 500 megacycles will typically deliver 27 watts useful power output with 6 watts driving power. As an r-f oscillator at 2500 megacycles the 2C39A will deliver a minimum of 12 watts useful power output.

GENERAL CHARACTERISTICS

ELECTRICAL

	Min.	Nom.	Max.	
Cathode: Oxide-Coated, Unipotential				
Heating Time	-	60		seconds
Heater: Voltage (See "Applications")	-	6.3		volts
Current	0.95		1.10	amperes
Amplification Factor	-	100		
Direct Interelectrode Capacitances (In Shielded Fixture):				
Grid-Plate	1.86		2.16	uuf
Grid-Cathode	5.60		7.60	uuf
Plate-Cathode	-	-	0.035	uuf
Transconductance (I_b=70 ma.)	20,000		30,000	umhos
Frequency for Maximum Ratings	-	-	2,500	mc

▶ MECHANICAL

Base, Socket and Connections	See drawing
Operating Position	Any
Cooling	Forced Air
Maximum Operating Temperatures:	
Ceramic-to-Metal Seals	250° C
Anode Core	250° C

Maximum Over-all Dimensions:	
Length	2.75 inches
Diameter	1.27 inches
Net Weight	2.5 ounces
Shipping Weight (Single Tube, Approx.)	7.0 ounces

RADIO-FREQUENCY POWER AMPLIFIER, OR OSCILLATOR

MAXIMUM RATINGS (Per tube)

D-C PLATE VOLTAGE	1000 MAX. VOLTS
D-C CATHODE CURRENT	125 MAX. MA
D-C GRID VOLTAGE	—150 MAX. VOLTS
D-C GRID CURRENT	50 MAX. MA
HEATER VOLTAGE	SEE APPLICATION NOTES
INSTANTANEOUS PEAK POSITIVE GRID VOLTAGE	30 MAX. VOLTS
INSTANTANEOUS PEAK NEGATIVE GRID VOLTAGE	400 MAX. VOLTS
PLATE DISSIPATION	100 MAX. WATTS
GRID DISSIPATION	2 MAX. WATTS

TYPICAL OPERATION (Key-down conditions, per tube)
(Power-Amplifier Grid-Isolation Circuit, CW Operation, 500 Mc.)

D-C Plate Voltage	800 volts
D-C Grid Voltage	—20 volts
D-C Plate Current	80 ma
D-C Grid Current	32 ma
Driving Power (approx.)[1]	6 watts
Useful Power Output	27 watts

TYPICAL OPERATION
(R-F Oscillator, 2500 Mc.)[2]

D-C Plate Voltage	900 volts
D-C Grid Voltage	—22 volts
D-C Plate Current	90 ma
D-C Grid Current	27 ma
Useful Power Output	12 watts

PLATE-MODULATED RADIO-FREQUENCY AMPLIFIER OR OSCILLATOR

MAXIMUM RATINGS (Carrier conditions, per tube)

D-C PLATE VOLTAGE[3]	600 MAX. VOLTS
D-C GRID VOLTAGE	—150 MAX. VOLTS
D-C GRID CURRENT	50 MAX. MA
D-C CATHODE CURRENT	100 MAX. MA
PEAK INSTANTANEOUS POSITIVE GRID VOLTAGE	30 MAX. VOLTS
PEAK INSTANTANEOUS NEGATIVE GRID VOLTAGE	400 MAX. VOLTS
PLATE DISSIPATION	70 MAX. WATTS
GRID DISSIPATION	2 MAX. WATTS

TYPICAL OPERATION
(Plate-Modulated Radio-Frequency Power Amplifier
Grid-Isolation Circuit, 500 Mc., Per Tube)

D-C Plate Voltage	600 volts
D-C Grid Voltage	—16 volts
D-C Plate Current	65 ma
D-C Grid Current	35 ma
Driving Power (approx.)[1]	5 watts
Useful Carrier Power Output	16 watts

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[1] Driving power listed is the total power which must be supplied to a practical grid circuit at the frequency shown.

[2] These 2500-megacycle conditions conform to the minimum requirements of the MIL-E-1 specifications for the 2C39A.

[3] For less than 100% modulation, higher d-c plate voltage may be used if the sum of the peak positive modulating voltage and the d-c plate voltage does not exceed 1200 volts.

(Effective 10-25-62) Copyright 1962 by Eitel-McCullough, Inc:

▶ Indicates change from sheet dated 1-1-61

APPLICATION

MECHANICAL

Mounting—The 2C39A may be operated in any position. It should be firmly held in place by spring-finger collets bearing on the terminal surfaces. The tube should seat against the under side of the "anode flange" (see outline drawing). In applications involving severe shock and vibration, the tube may be clamped in place by applying a suitable clamping device to the anode flange. It is recommended that no other portion of the tube be subjected to clamping forces.

Connections—The tube terminals are in the form of concentric cylinders of graduated diameters so that the 2C39A may be conveniently used with coaxial tuning devices. Spring-finger collets should be used to make contact with the anode, grid, cathode, and heater terminals. Adequate contact area and spring pressure should be provided to minimize heating and to prevent erratic circuit performance at the higher frequencies. Non-contacting or intermittently-contacting collet fingers will cause troublesome circuit behavior, especially at very-high and ultra-high frequencies. Electrode contact surfaces should be kept clean and free of oxide coatings.

Cooling—Sufficient cooling must be provided for the anode and body seals to maintain operating temperatures below the rated maximum values:

Ceramic to Metal Seals	250°C
Anode Core	250°C

At sea level, with an inlet air temperature of 25°C, 13.0 cubic feet per minute of air flow is required to cool the anode at 100 watts plate dissipation when the air cowling as illustrated is used. Pressure across the anode under these conditions is 0.6 inches of water. Operation at higher altitudes or with higher inlet temperatures requires increased volumes of flow to obtain equivalent cooling. When using the anode cowling as illustrated here, it is necessary to provide additional facilities for seal cooling.

It should be borne in mind that operating temperature is the sole criterion of cooling effectiveness, regardless of the coolant type, flow rate or coolant temperature.

ELECTRICAL

Heater Operation—The rated heater voltage for the 2C39A is 6.3 volts and the working voltage should be determined from the table below. The heater voltage should be maintained within plus or minus 10% of its intended value to minimize variations in circuit performance and to obtain maximum tube life.

At ultra-high frequencies transit-time effects can influence the cathode temperature. The amount of r-f driving power diverted to heating the cathode by back-bombardment will depend upon the frequency, the plate current, and the r-f driving power being supplied to the tube. The following table is intended as a general guide.

Frequency (Mc.)	E_f (Volts)
Up to 400	6.3
400 to 1000	6.0
1000 to 1500	5.5
1500 to 2000	5.0
2000 and above	4.5

If the conditions of operation result in extreme cathode back-heating, it may be necessary to start dynamic tube operation at normal heater voltage followed by a reduction of heater voltage to the proper value.

Cathode Operation—The oxide-coated unipotential cathode in the 2C39A and one side of the heater are connected internally. The absolute maximum rated d-c current is 125 milliamperes.

It is recommended that rated heater voltage be applied for a minimum of 30 seconds before other operating voltages are applied. Tube performance will become stabilized approximately 60 seconds after the heater voltage is applied.

Control-Grid Operation—The maximum rated grid dissipation is 2.0 watts.

At operating frequencies near 500 megacycles, the driving power necessary for maximum output of a typical grounded-grid amplifier is in the order of 6 watts and as the operating frequency is increased, the driving power requirements increase. Most of this additional driving power is absorbed in circuit losses other than grid dissipation, however, and the actual grid dissipation will increase very little.

The grid bias required by various 2C39A tubes may vary between limits approximately 50% above and below the nominal value and means should be provided in the equipment to accommodate such variations.

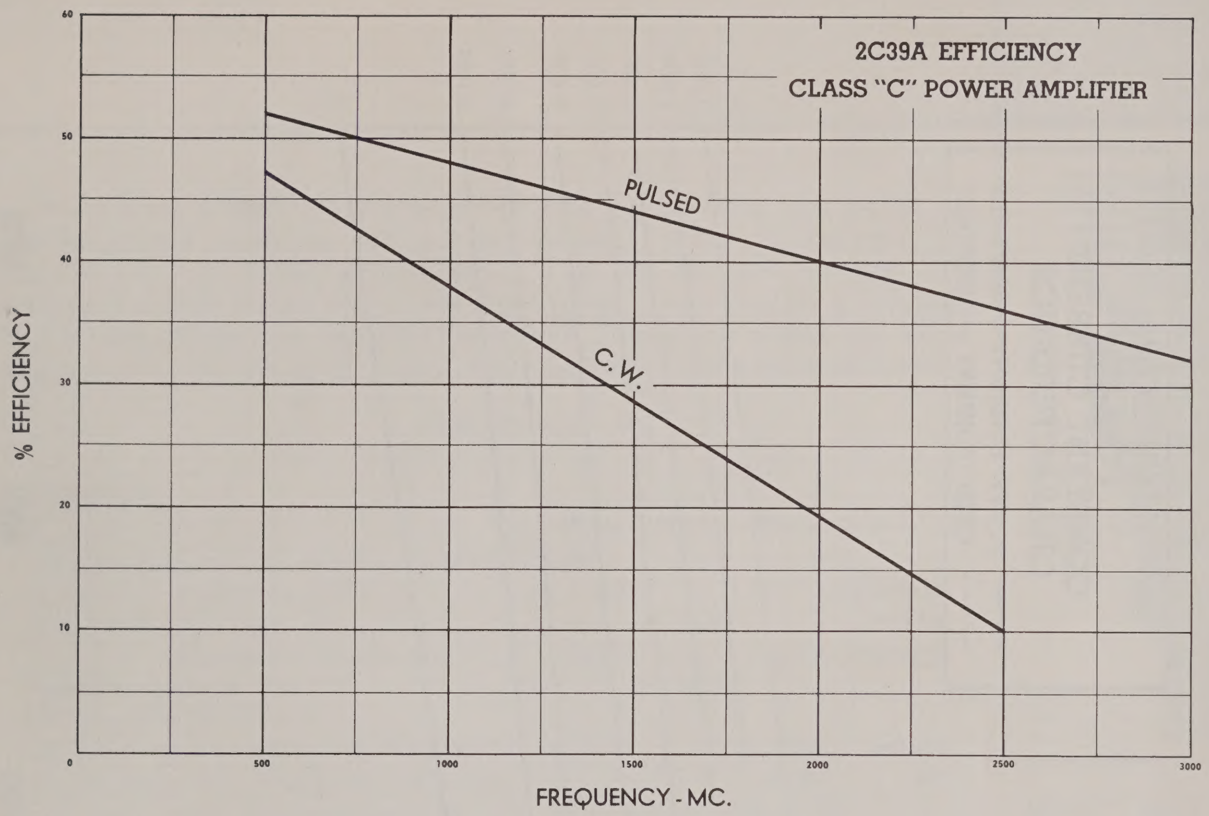
When grid-leak bias is used, suitable means must be provided to protect the tube against loss of excitation at plate voltages above 600 volts and the grid-leak resistor should be made variable to facilitate maintaining the bias voltage and plate current at the desired values when tubes are changed in the equipment.

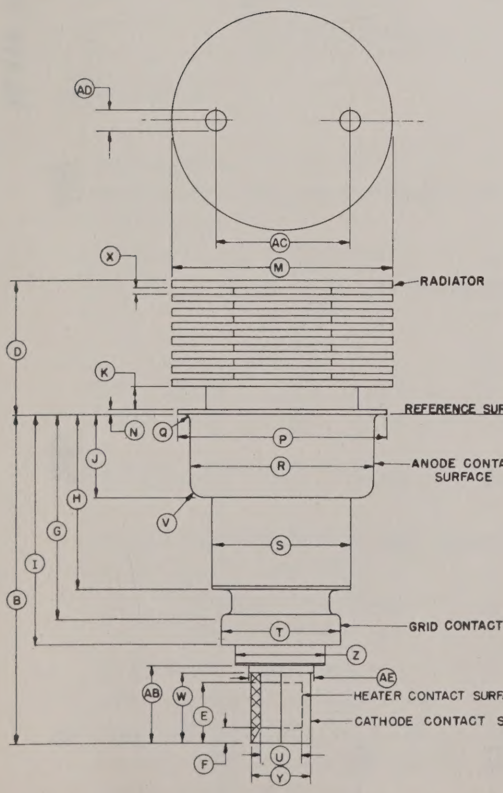
Plate Operation—The maximum rated plate dissipation is 100 watts. In plate-modulated applications, the plate dissipation under carrier conditions must be limited to 70 watts to avoid exceeding the plate-dissipation rating with 100% sine-wave modulation.

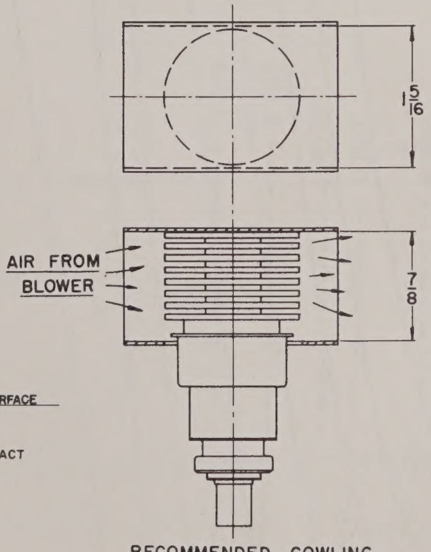
In general, low-voltage high-current operation is preferable to high-voltage low-current operation from the standpoint of optimum life.

An excellent indication of operating conditions is the ratio of grid current to plate current; when the 2C39A is operated with grid-current values greater than half those of the plate current, either the drive is excessive or the plate loading is too light for the excitation present. The tube should never be operated unloaded, even for short periods of time. Drive should be held to the lowest value consistent with reasonable efficiency.

Special Applications—If it is desired to operate this tube under conditions widely different from those given here, write to Eitel-McCullough, Inc., San Carlos, California, for information and recommendations.





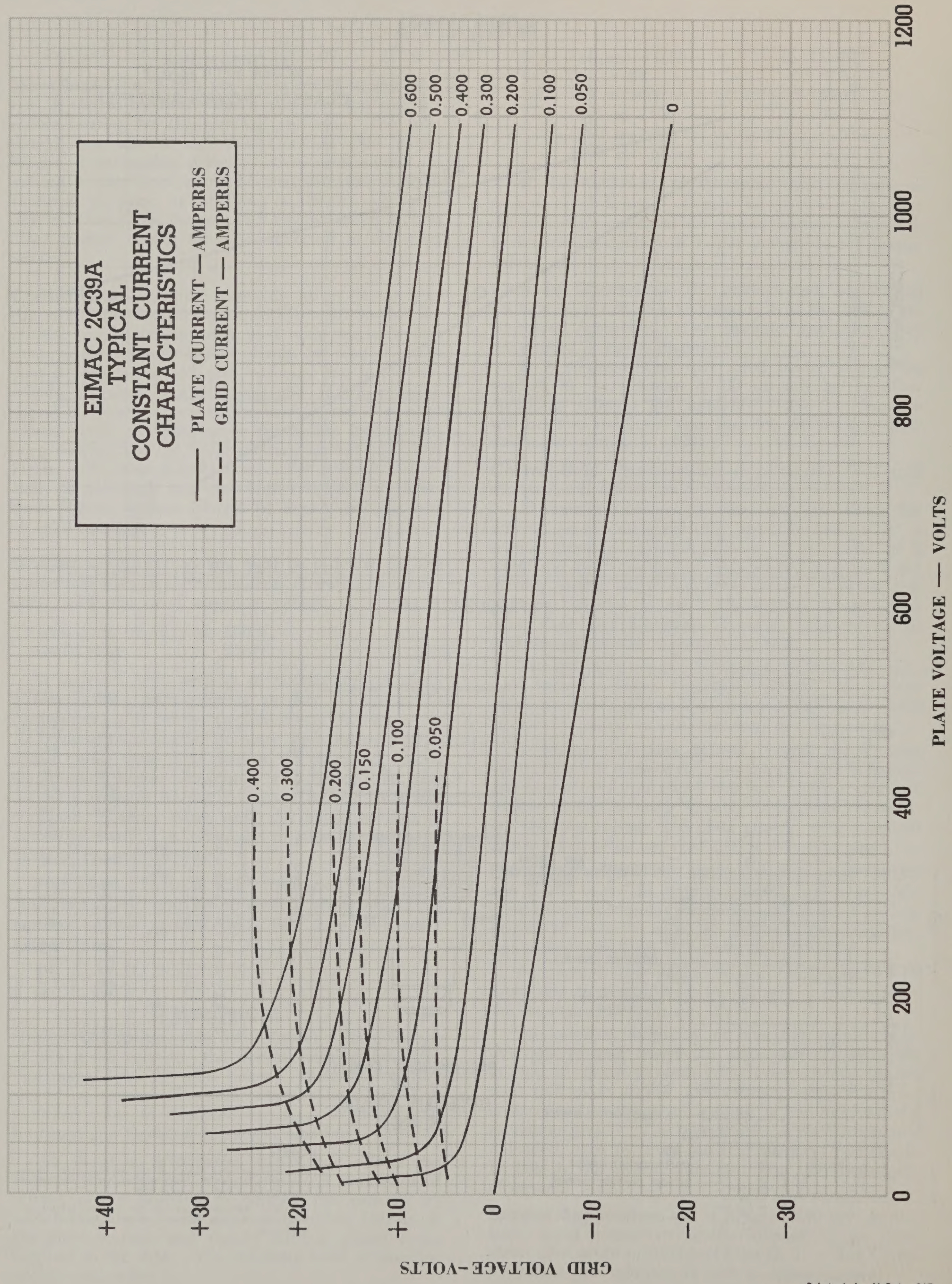


RECOMMENDED COWLING FOR FORCED-AIR COOLING OF ANODE

REF.	NOM.	MIN.	MAX.
B		1.815	1.875
D		.766	.826
E		.341	.401
F		.026	.086
G		1.095	1.135
H		.880	.920
I		1.289	1.329
J		.462	.477
K		.125	.185
M		1.234	1.264
N	.031		
P		1.180	1.195
Q	.031		
R		1.024	1.039
S		.752	.792
T		.653	.668
U		.213	.223
V	.094		
W		.400	.460
X		.016	.046
Y		.313	.328
Z		.455	.470
AB		.420	.480
AC	.750		
AD	.125		
AE		.333	.348

NOTES:

1. The total indicated runout of the anode contact surface and the grid contact surface with respect to the cathode contact surface shall not exceed .020.
2. The total indicated runout of the cathode contact surface with respect to the heater contact surface shall not exceed .012.

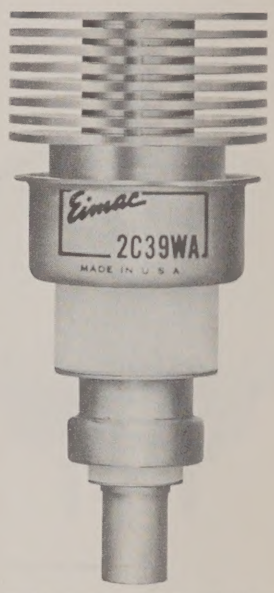

EIMAC 2C39A
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
— PLATE CURRENT — AMPERES
- - - GRID CURRENT — AMPERES
0.600
0.500
0.400
0.300
0.200
0.100
0.050
0
0.400
0.300
0.200
0.150
0.100
0.050
+40
+30
+20
+10
0
−10
−20
−30
GRID VOLTAGE—VOLTS
0
200
400
600
800
1000
1200
PLATE VOLTAGE — VOLTS

EITEL-McCULLOUGH, INC.
SAN CARLOS, CALIFORNIA

TENTATIVE DATA

2C39WA

HIGH-MU UHF TRIODE



The Eimac 2C39WA is a planar triode of ceramic and metal construction designed for use as an oscillator, frequency multiplier, or power amplifier in the VHF and UHF ranges and particularly suitable for use in grid-isolation circuits. The Eimac 2C39WA is manufactured and tested to exacting tolerances to insure consistent and uniform tube performance.

CHARACTERISTICS

ELECTRICAL

	Min.	Nom.	Max.	
Cathode: Oxide-Coated, Unipotential				
Heating Time	60			seconds
Heater: Voltage		5.8		volts
Current (E_f=5.8v)	0.87		1.03	ampere
Amplification Factor		100		
Transconductance (E_f=5.5v, E_b=600v, R_k=30ohms)	18,000		30,000	umhos
Frequency for Maximum Ratings			2500	mc

Interelectrode Capacitances (In Shielded Fixture):

	Min.	Max.	
Grid-Cathode	5.6	7.6	uuf
Grid-Plate	1.86	2.16	uuf
Plate-Cathode		0.035	uuf

MECHANICAL

Terminals	Graduated cylindrical surfaces
Maximum Seal and Anode Core Temperature	200° C
Cooling	Forced air
Operating Position	Any
Maximum Over-All Dimensions:	
Length	2.75 inches
Diameter	1.27 inches
Net Weight	2.5 ounces
Shipping Weight (Approximate)	7 ounces

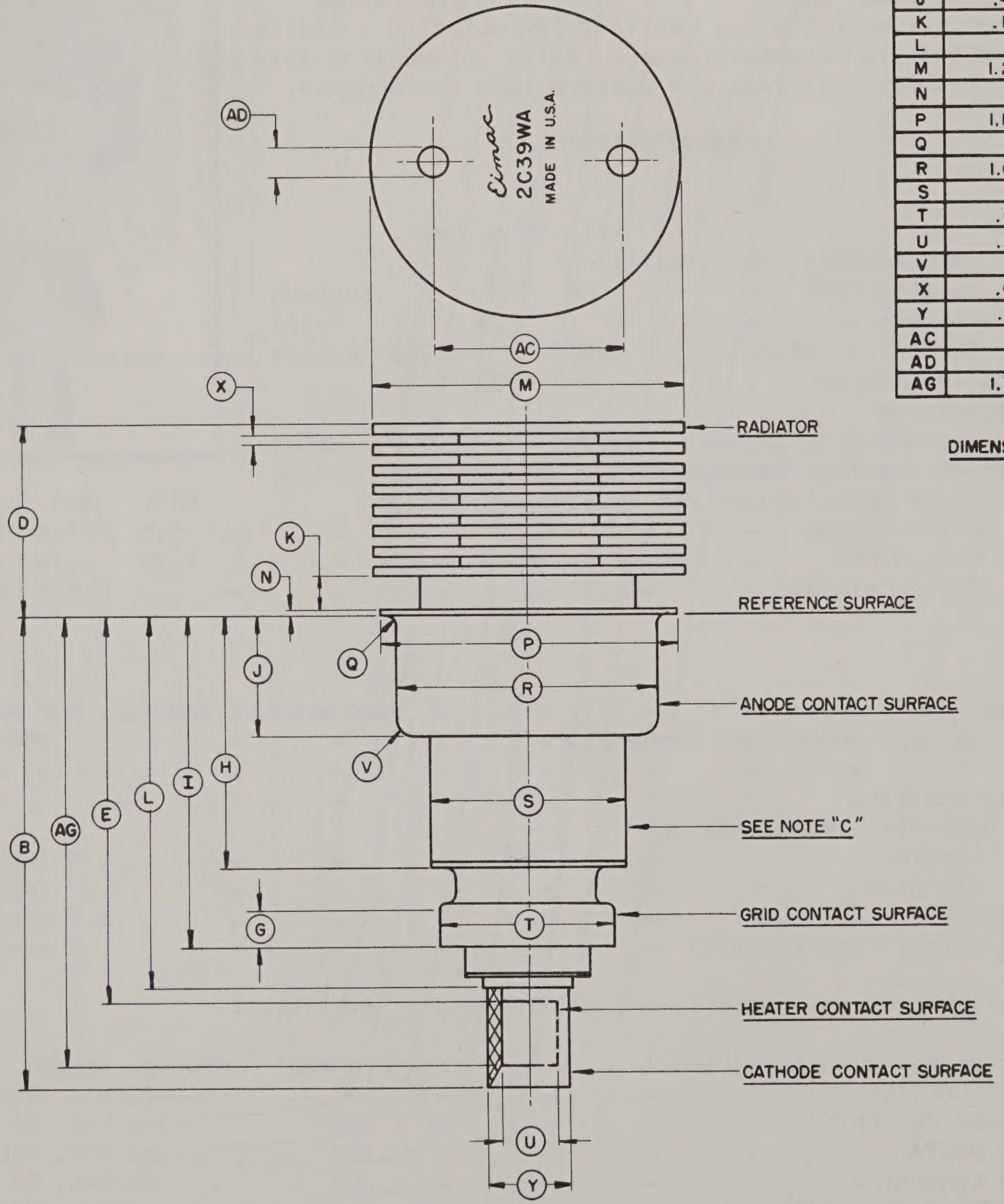
MAXIMUM RATINGS Class-C oscillator, multiplier, or amplifier.

(Carrier or key-down conditions)	(Plate Mod)	(Teleg. or FM)	
D-C PLATE VOLTAGE	600	1000	MAX. VOLTS
D-C CATHODE CURRENT	100	125	MAX. MA
D-C GRID VOLTAGE	-150	-150	MAX. VOLTS
D-C GRID CURRENT	50	50	MAX. MA
INSTANTANEOUS PEAK POSITIVE GRID VOLTAGE	30	30	MAX. VOLTS
INSTANTANEOUS PEAK NEGATIVE GRID VOLTAGE	400	400	MAX. VOLTS
PLATE DISSIPATION (WITH 12.5 CFM AIR FLOW)	70	100	MAX. WATTS
GRID DISSIPATION	2	2	MAX. WATTS

(Effective 2-7-58) Copyright 1958 by Eitel-McCullough, Inc.

DIMENSION DATA		
REF.	MIN.	MAX.
B	1.805	1.875
D	.736	.826
E		1.534
G	.140	
H		1.000
I	1.289	1.329
J	.459	.479
K	.125	
L		1.475
M	1.234	1.266
N	.031	
P	1.175	1.199
Q	.031	
R	1.021	1.039
S		.813
T	.652	.668
U	.213	.223
V		.094
X	.016	
Y	.312	.328
AC	.750	
AD	.125	
AG	1.719	

DIMENSIONS IN INCHES



Eimac®

EITEL-McCULLOUGH, INC.
SAN CARLOS, CALIFORNIA

TENTATIVE DATA

8163
3-400Z

HIGH-MU POWER TRIODE

The Eimac 8163/3-400Z is a compact power triode intended to be used as a zero-bias Class-B amplifier in audio or radio-frequency applications. Operation with zero grid bias simplifies associated circuity by eliminating the bias supply. In addition, grounded-grid operation is attractive since a power gain as high as twenty times can be obtained with the 8163/3-400Z in a cathode-driven circuit.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten		
Voltage	5.0	volts
Current	14.5	amperes
Amplification Factor (Average)	200	
Interelectrode Capacitances (Average): †		
Grid-Filament	7.4	uuf
Grid-Plate	4.1	uuf
Plate-Filament	0.07	uuf
Frequency for Maximum Ratings	110	Mc

MECHANICAL

Base	5 Pin Special
Basing	See Drawing
Mounting Position	Vertical, base down or up
Cooling	Radiation and forced air
Heat-Dissipating Plate Connector	Supplied mounted on tube
Recommended Socket	Eimac SK-410
Recommended Chimney	Eimac SK-416
Maximum Operating Temperatures:	
Plate Seal	225°C
Base Seals	200°C
▶ Maximum Over-all Dimensions:	
Height	5.25 inches
Diameter	3.57 inches
Net Weight	7 ounces

† In Shielded Fixture

(Effective 6-1-62) Copyright 1961 by Eitel-McCullough, Inc.

▶ Indicates change from sheet dated 7-15-61

R-F LINEAR AMPLIFIER GROUNDED-GRID, CLASS-B

MAXIMUM RATINGS

D-C PLATE VOLTAGE	3000	MAX. VOLTS
D-C PLATE CURRENT	0.400	MAX. AMP
PLATE DISSIPATION	400	MAX. WATTS
GRID DISSIPATION	20	MAX. WATTS

TYPICAL OPERATION (Minimum Distortion Products)

D-C Plate Voltage	2000 volts
Zero-Sig D-C Plate Current*	62 ma
Single-Tone D-C Plate Current	400 ma
Single-Tone D-C Grid Current	148 ma
Two-Tone D-C Plate Current	265 ma
Two-Tone D-C Grid Current	87 ma
Peak Envelope Useful Output Power	445 watts
Resonant Load Impedance	2750 ohms

Intermodulation Distortion
Products - 40 db or more below PEP level

TYPICAL OPERATION (Single-Tone Conditions)

D-C Plate Voltage	3000 volts
Zero-Sig D-C Plate Current*	100 ma
Max-Sig D-C Plate Current	333 ma
Max-Sig D-C Grid Current	120 ma
Driving Impedance	122 ohms
Resonant Load Impedance	4750 ohms
Max-Sig Driving Power	32 watts
Peak Envelope Plate Output Power	655 watts

TYPICAL OPERATION (Minimum Distortion Products at 1 KW PEP Input)

D-C Plate Voltage	2500 volts
Zero-Sig D-C Plate Current*	73 ma
Single-Tone D-C Plate Current	400 ma
Single-Tone D-C Grid Current	142 ma
Two-Tone D-C Plate Current	274 ma
Two-Tone D-C Grid Current	82 ma
Peak Envelope Useful Output Power	560 watts
Resonant Load Impedance	3450 ohms

Intermodulation Distortion
Products - 35 db or more below PEP level

TYPICAL OPERATION (Minimum Distortion Products at 1500 Volts Plate Voltage)

D-C Plate Voltage	1500 volts
Zero-Sig D-C Plate Current*	46 ma
Single-Tone D-C Plate Current	400 ma
Single-Tone D-C Grid Current	163 ma
Two-Tone D-C Plate Current	265 ma
Two-Tone D-C Grid Current	92 ma
Peak Envelope Useful Output Power	300 watts
Resonant Load Impedance	1620 ohms

Intermodulation Distortion
Products - 37 db or more below PEP level

AUDIO FREQUENCY AMPLIFIER OR MODULATOR, CLASS-B

MAXIMUM RATINGS (PER TUBE)

D-C PLATE VOLTAGE	3000	MAX. VOLTS
D-C PLATE CURRENT	0.400	MAX. AMP
PLATE DISSIPATION	400	MAX. WATTS
GRID DISSIPATION	20	MAX. WATTS

TYPICAL OPERATION (Sinusoidal Wave, Two Tubes, Grid Driven)

D-C Plate Voltage	3000 volts
D-C Grid Voltage	0 volts
Zero-Sig D-C Plate Current*	200 ma
Max-Sig D-C Plate Current	666 ma
Max-Sig D-C Grid Current	240 ma
Driving Power	26 watts
Peak A-F Driving Voltage (per tube)	88 volts
Load Resistance, Plate-to-Plate	9500 ohms
Max-Sig Plate Output Power	1310 watts

*Approximate Value

R-F POWER AMPLIFIER OR OSCILLATOR, CLASS-C

MAXIMUM RATINGS		
D-C PLATE VOLTAGE	4000 MAX.	VOLTS
D-C PLATE CURRENT	0.350 MAX.	AMP
PLATE DISSIPATION	400 MAX.	WATTS
GRID DISSIPATION	20 MAX.	WATTS

TYPICAL OPERATION	
D-C Plate Voltage	3000 volts
D-C Plate Current	333 ma
D-C Grid Voltage	-75 volts
D-C Grid Current	130 ma
Peak R-F Grid Voltage	187 volts
Grid Driving Power	25 watts
Plate Output Power	730 watts

PLATE-MODULATED R-F POWER AMPLIFIER

MAXIMUM RATINGS		
D-C PLATE VOLTAGE	3000 MAX.	VOLTS
D-C PLATE CURRENT	0.275 MAX.	AMP
PLATE DISSIPATION	270 MAX.	WATTS
GRID DISSIPATION	20 MAX.	WATTS

TYPICAL OPERATION	
D-C Plate Voltage	3000 volts
D-C Plate Current	245 ma
D-C Grid Voltage	-90 volts
D-C Grid Current	100 ma
Peak R-F Grid Voltage	185 volts
Grid Driving Power	18 watts
Plate Output Power	550 watts

NOTE: In most cases, "TYPICAL OPERATION" data are obtained by calculation from published characteristic curves and confirmed by direct tests. No allowance for circuit losses, either input or output, has been made. Exceptions are distinguished by a listing of "Useful" output power as opposed to "Plate" output power. Values appearing in these groups have been obtained from existing equipment(s) and the output power is that measured at the load.

APPLICATION

Mounting -- The 3-400Z must be operated vertically, base up or base down. A flexible connecting strap should be provided between the heat dissipating plate connector and the external plate circuit. The tube must be protected from severe vibration and shock.

▶ **Cooling** --Forced-air cooling is required to maintain the base seals at a temperature below 200°C, and the plate seal at a temperature below 225°C. When using the Eimac SK-410 Air-System Socket and SK-416 Chimney, a minimum air flow rate of 13 cubic feet per minute at a static pressure of approximately 0.13 inch of water at sea level is required to provide adequate cooling at an inlet air temperature of 55°C. At higher inlet air temperatures, higher altitudes, or at frequencies above 30 Mc, the air flow rate must be increased to give equivalent cooling. Cooling air must be supplied to the tube even when the filament alone is on during standby periods.

When a socket other than the SK-410 is used, provisions must be made for equivalent cooling of the base, the envelope, and the plate lead. In all cases, air flow rates in excess of the minimum requirements will prolong tube life.

▶ Indicates change from sheet dated 7-15-61

Class-C Operation -- Although specifically designed for class-B service, the 3-400Z may be operated as a class-C power amplifier or oscillator or as a plate-modulated radio-frequency power amplifier. The zero-bias characteristic of the 3-400Z can be used to advantage in class-C amplifiers operating at plate voltages of 3000 volts or below be employing only grid-leak bias. If driving power fails, plate dissipation is then kept to a low value because the tube will be operating at the normal static zero-bias conditions.

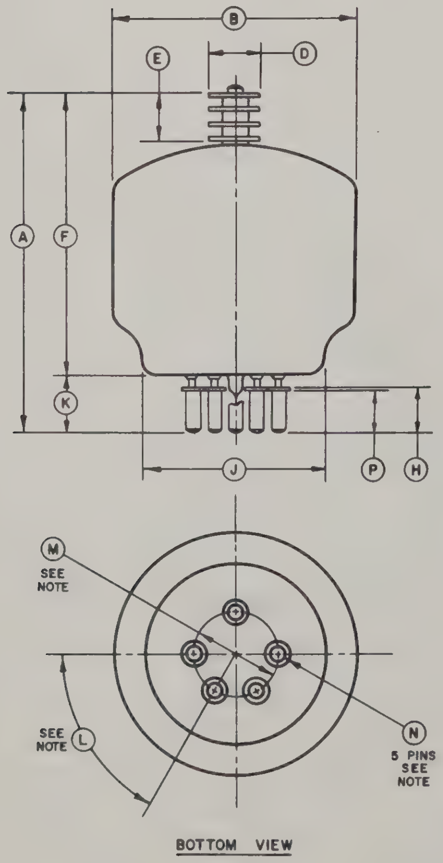
Filament Operation -- The rated filament voltage for the 3-400Z is 5.0 volts. Filament voltage, as measured at the socket, must be maintained within the range of 4.75 to 5.25 volts to obtain maximum tube life.

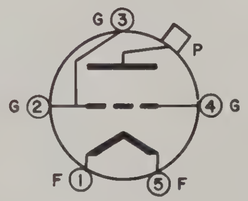
Intermodulation Distortion -- Typical Operating conditions with distortion values included are the result of data taken during actual operation at 2 megacycles. Intermodulation values listed are those measured at the full peak envelope power noted. As the driving signal level is reduced, distortion products remain at the listed value, or better, below original peak envelope power level.

Input Circuit -- When the 3-400Z is operated as a grounded-grid r-f amplifier, the use of a resonant tank in the cathode circuit is recommended in order to obtain greatest linearity and power output. For best results with a single-ended amplifier it is suggested that the cathode tank circuit operate at a "Q" of five or more.

Special Applications -- If it is desired to operate this tube under conditions widely different from those given here, write to Power Grid Tube Marketing, Eitel-McCullough, Inc., 301 Industrial Way, San Carlos, California, for information and recommendations.

3-400Z OUTLINE DRAWING AND PIN CONNECTIONS





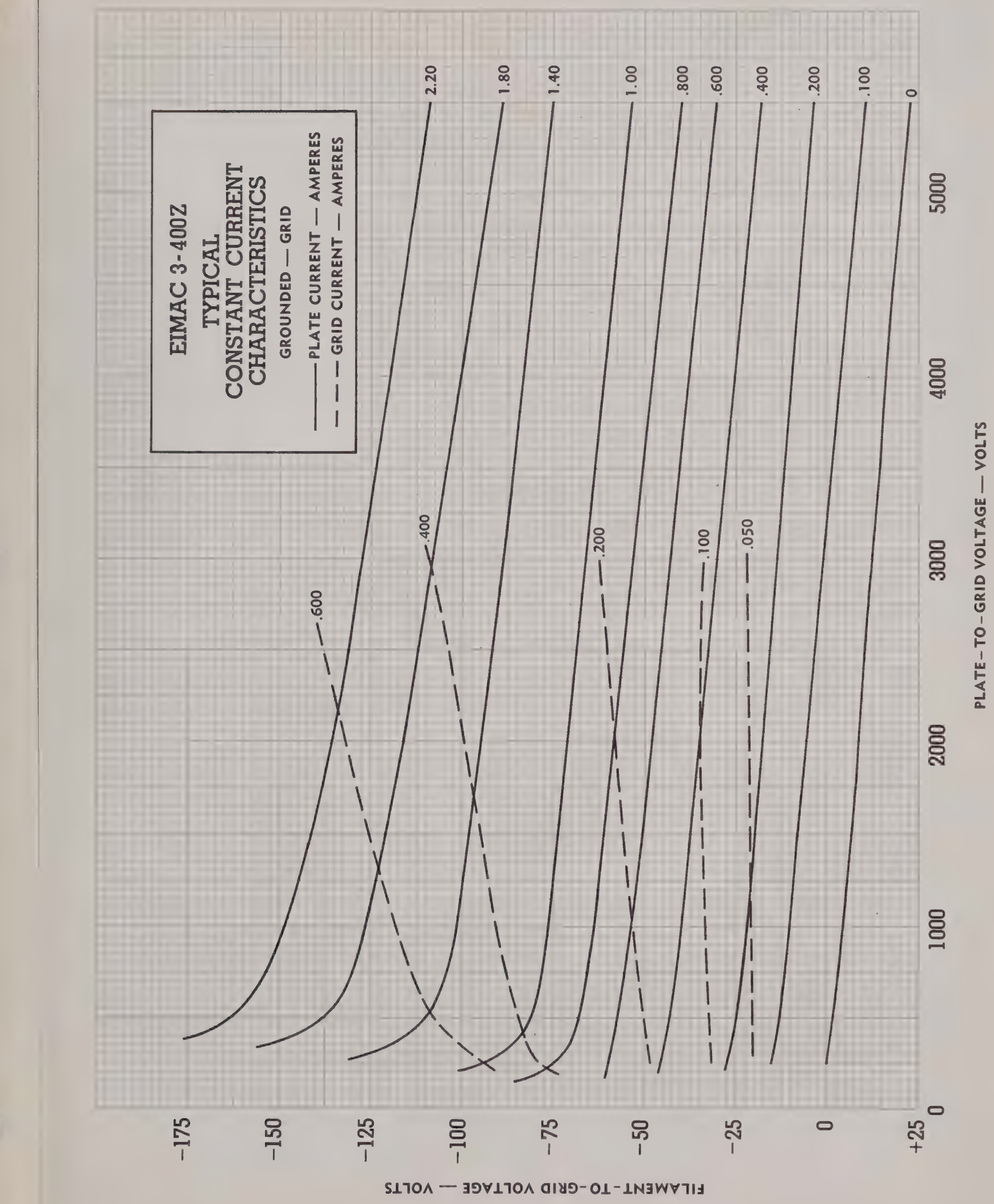
NOTE:
BASE PINS Ⓝ ARE SO ALIGNED THAT THEY CAN BE FREELY INSERTED INTO A GAUGE 1/4" THICK WITH HOLE DIA'S. OF .204 LOCATED ON THE TRUE CENTERS BY THE GIVEN DIMS. Ⓛ & Ⓜ.

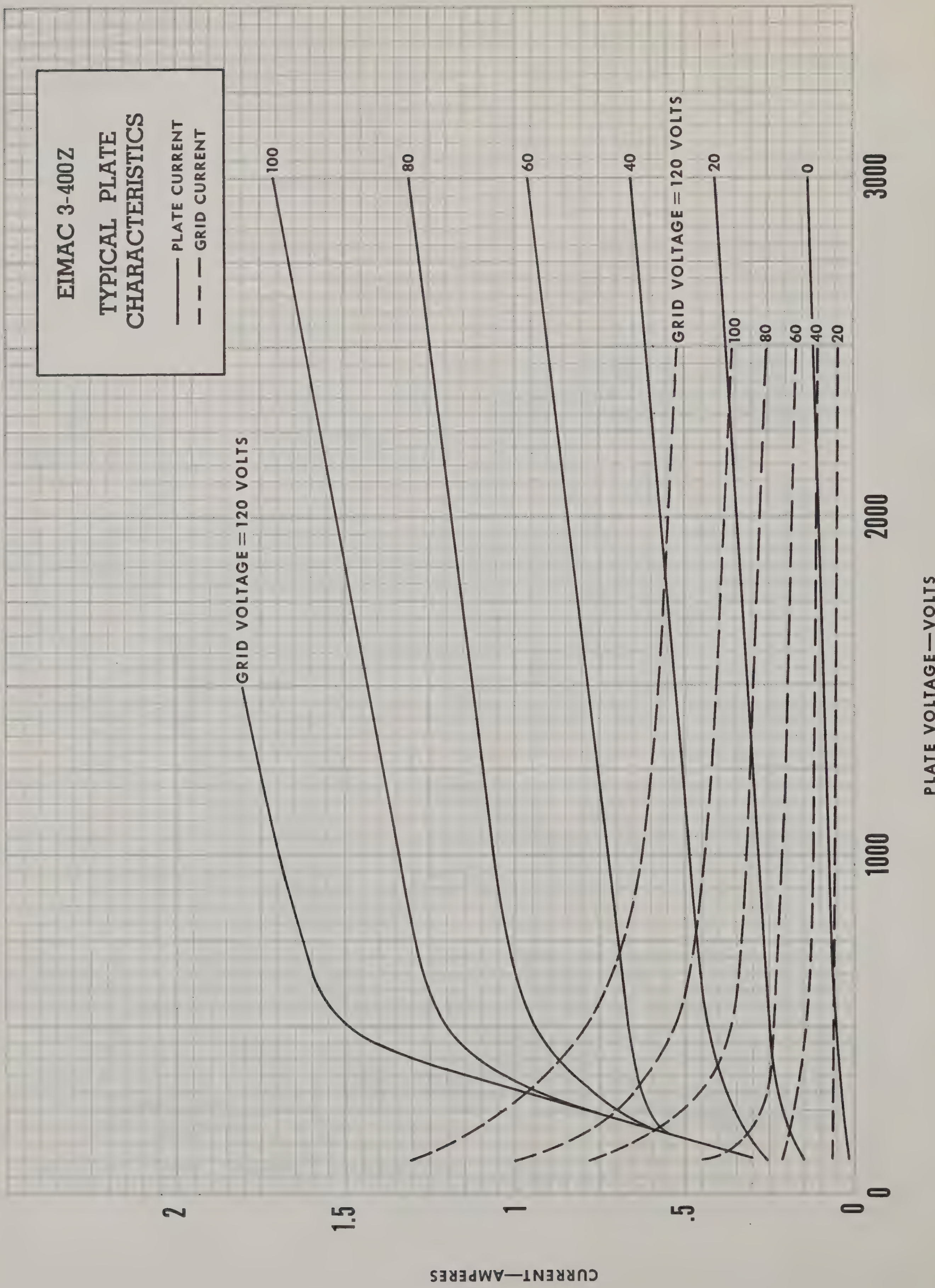
DIMENSIONS IN INCHES

DIMENSIONAL DATA

REF.	MIN.	MAX.	NOM.
▶ A	4-3/4	5-1/4	
B		3-9/16 D.	
D	.745 D.	.755 D.	
E	.640	.660	
▶ F	3-15/16	4-7/16	
H	9/16	11/16	
J		2-1/2 D.	
K			13/16
L			60° TYP.
M			1-1/4 D. P.C.
N	.185 D.	.191 D.	
P	1/2	5/8	

▶ Indicates change from sheet dated 7-15-61

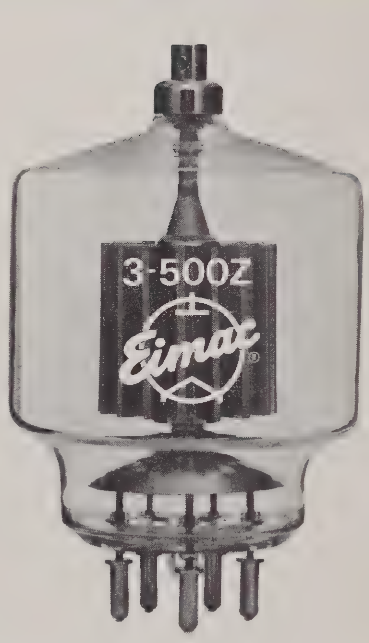

EIMAC 3-400Z
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
GROUNDED — GRID
—— PLATE CURRENT — AMPERES
— — GRID CURRENT — AMPERES
2.20
1.80
1.40
1.00
.800
.600
.400
.200
.100
0
.600
.400
.200
.100
.050
0
1000
2000
3000
4000
5000
PLATE-TO-GRID VOLTAGE — VOLTS
-175
-150
-125
-100
-75
-50
-25
0
+25
FILAMENT-TO-GRID VOLTAGE — VOLTS


EIMAC 3-400Z
TYPICAL PLATE CHARACTERISTICS
PLATE CURRENT
GRID CURRENT
GRID VOLTAGE = 120 VOLTS
100
80
60
40
GRID VOLTAGE = 120 VOLTS
20
0
100
80
60
40
20
0
1000
2000
3000
PLATE VOLTAGE—VOLTS
0
.5
1
1.5
2
CURRENT—AMPERES

TECHNICAL DATA

3-500Z

HIGH-MU POWER TRIODE



The EIMAC 3-500Z is a compact power triode intended to be used as a zero-bias Class-AB_2 amplifier in audio or radio-frequency applications. Operation with zero grid bias simplifies associated circuitry by eliminating the bias supply. In addition, grounded-grid operation is attractive since a power gain as high as twenty times can be obtained with the 3-500Z in a cathode-driven circuit.

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Filament: Thoriated Tungsten	
Voltage	5.0 ± 0.25 V
Current, at 5.0 volts	14.5 A
Amplification Factor (Average)	130
Direct Interelectrode Capacitances (grounded filament)[2]	
Input	8.3 pF
Output	0.07 pF
Feedback	4.7 pF
Direct Interelectrode Capacitances (grounded grid)[2]	
Input	8.3 pF
Output	4.7 pF
Feedback	0.07 pF
Frequency of Maximum Rating:	
CW	110 MHz

---

1. Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.
2. In Shielded Fixture.

MECHANICAL

Maximum Overall Dimensions:	
Length	5.875 in; 149.23 mm
Diameter	3.438 in; 87.33 mm
Net Weight	7.0 oz; 198.5 gm
Operating Position	Vertical, base down or up
Maximum Operating Temperature:	
Plate Seal	225°C
Base Seals	200°C
Cooling	Radiation and forced air
Base	5 Pin Special

(Revised 2-1-71) © 1968, 1970 by Varian Printed in U.S.A.

Recommended Socket	EIMAC SK-410
Recommended Chimney	EIMAC SK-406
Recommended Heat-Dissipating Connector:	
Plate	HR-6

RADIO FREQUENCY LINEAR AMPLIFIER CATHODE DRIVEN

Class AB_2

MAXIMUM RATINGS:

DC PLATE VOLTAGE	4000	VOLTS
DC PLATE CURRENT	0.4	AMPERE
PLATE DISSIPATION	500	WATTS
GRID DISSIPATION	20	WATTS

TYPICAL OPERATION (Frequencies to 110 MHz)
Class AB2, Peak Envelope or Modulation Crest Conditions

Plate Voltage	1500	2000	2500	3000	3500	Vdc
Cathode Voltage[1]	0	0	0	+10	+15	Vdc
Zero Signal Plate Current[2]	65	95	130	62	53	mAdc
Single-Tone Plate Current, CW[3/4]	400	400	400	400	400	mAdc
Two-Tone Plate Current	260	270	280	268	262	mAdc
Single-Tone Grid Current[2]	130	130	120	108	108	mAdc
Two-Tone Grid Current[2]	80	80	70	60	58	mAdc
Single-Tone Power Input	600	800	1000	1200	1400	W
Useful Output Power, CW or PEP	330	500	600	740	890	W
Resonant Load Impedance	1600	2750	3450	4200	5000	Ω
Intermodulation Distortion Products[5]						
3rd Order	-46	-38	-33	-40	-40	db
5th Order	---	---	---	-46	-45	db

1. Zener diode positive bias used at plate potentials of 3 kV and above.
2. Approximate value.
3. Currents listed correspond to SSB, or "two-tone" average current at peak of signal envelope.
4. Single-tone current for 3500 Vdc operation may reach this value during short periods of circuit adjustment only.
5. Intermodulation distortion products are referenced against one tone of a two equal tone signal.

RADIO FREQUENCY POWER AMPLIFIER OR OSCILLATOR GRID DRIVEN, CATHODE DRIVEN

Class AB_2 and C Telegraphy or FM Telephony
(Key-Down Conditions)

MAXIMUM RATINGS:

DC PLATE VOLTAGE	4000	VOLTS
DC PLATE CURRENT	0.35	AMPERE
PLATE DISSIPATION	500	WATTS
GRID DISSIPATION	20	WATTS

TYPICAL OPERATION (Frequencies to 110 MHz)

	Grid Driven		Cathode Driven		
Plate Voltage	3000	3500	3000	3500	Vdc
Grid Voltage	0	-75	0	-75	Vdc
Plate Current	350	300	333	350	mAdc
Grid Current	115	115	108	118	mAdc
Peak rf (Cathode) (Grid) Voltage	---	187	215	215	v
Measured Driving Power	30	22	87	98	W
Plate Input Power	1050	1050	1000	1225	W
Plate Dissipation	330	200	250	305	W
Useful Output Power	720	850	750	920	W
Resonant Load Impedance	4200	5700	4800	5500	Ω

PLATE MODULATED RADIO FREQUENCY POWER AMPLIFIER-GRID DRIVEN

Class C Telephony (Carrier Conditions)

MAXIMUM RATINGS:

DC PLATE VOLTAGE	3000	VOLTS
DC PLATE CURRENT	0.275	AMPERE
PLATE DISSIPATION[1]	330	WATTS
GRID DISSIPATION[2]	20	WATTS

1. Corresponds to 500 watts at 100% sine-wave modulation.
2. Average, with or without modulation.

TYPICAL OPERATION (Frequencies to 30 MHz)

Plate Voltage	3000	Vdc
Grid Voltage	-100	Vdc
Plate Current	275	mAdc
Grid Current[1]	120	mAdc
Peak rf Grid Voltage[1]	200	v
Calculated Driving Power	25	W
Plate Input Power	825	W
Plate Dissipation	185	W
Plate Output Power	640	W

1. Approximate value.

AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR

Class AB_2, Grid Driven (Sinusoidal Wave)

MAXIMUM RATINGS (Per Tube):

DC PLATE VOLTAGE[1]	4000	VOLTS
DC PLATE CURRENT	0.4	AMPERE
PLATE DISSIPATION	500	WATTS
GRID DISSIPATION	20	WATTS

1. See zero-bias operation in Application Section.
2. Approximate value.
3. Per Tube.
4. Nominal drive power is one-half peak power.

TYPICAL OPERATION (Two Tubes)

Plate Voltage	3000	Vdc
Grid Voltage	0	Vdc
Zero-Signal Plate Current[2]	300	mAdc
Max. Signal Plate Current	770	mAdc
Max. Signal Grid Current[2]	244	mAdc
Peak af Grid Voltage[3]	100	v
Peak Driving Power[4]	25	w
Plate Input Power	2310	W
Max. Signal Plate Dissipation	890	W
Plate Output Power	1420	W
Load Resistance (plate to plate)	8600	Ω

NOTE: TYPICAL OPERATION data are obtained by calculation from published characteristic curves or actual measurment. Adjustment of the rf grid voltage to obtain the specified plate current at the specified bias and plate voltages is assumed. If this procedure is followed, there will be little variation in output power when the tube is changed, even though there may be some variation in grid current. The grid current which results when the desired plate current is obtained is incidental and varies from tube to tube. These current variations cause no difficulty so long as the circuit maintains the correct voltage in the presence of the variations in current. If grid bias is obtained principally by means of a grid resistor, the resistor must be adjustable to obtain the required bias voltage when the correct rf grid voltage is applied.

RANGE VALUES FOR EQUIPMENT DESIGN	Min.	Max.	
Filament: Current at 5.0 volts	13.5	14.7	A
Interelectrode Capacitances[1] (grounded filament connection)			
Input	6.5	10.0	pF
Output	---	0.18	pF
Feedback	4.2	5.2	pF
Interelectrode Capacitances[1] (grounded grid connection)			
Input	6.5	10.0	pF
Output	4.2	5.2	pF
Feedback	---	0.18	pF
Zero Signal Plate Current: $(E_c = 0\text{Vdc}, E_b = 2500\text{ Vdc})$	90	180	mAdc

APPLICATION

MECHANICAL

MOUNTING - The 3-500Z must be operated vertically, base up or down. A flexible connecting strap should be provided between the heat dissipating plate connector and the external plate circuit. The tube must be protected from severe vibration and shock.

SOCKET - The EIMAC SK-410 air system socket and SK-406 chimney are recommended for use with the 3-500Z. When a socket other than the SK-410 is used, provisions must be made for equivalent cooling of the base, the envelope, and the plate lead.

If a socket other than the EIMAC SK-410 is employed, the user must assure himself that lateral pressure is not applied to the tube pins and base seal. Otherwise damage to the tube may result.

CAUTION-GLASS IMPLOSION - The EIMAC 3-500Z is pumped to a very high vacuum, which is contained by a glass envelope. When handling a glass tube, remember that glass is a relatively fragile material, and accidental breakage can result at any time. Breakage will result in flying glass fragments, so safety glasses, heavy clothing, and leather gloves are recommended for protection.

COOLING - Forced-air cooling is required to maintain the base seals at a temperature below 200°C, and the plate seal at a temperature below 225°C. Air-flow requirements to maintain the above maximum temperatures are tabulated below. (For operation below 30 MHz)

Base-to-Anode Air Flow		
Anode Dissipation (Watts)	Air Flow (CFM)	Pressure Drop (inches-WC)
300	6.6	.023
400	10.3	.052
500	13.0	.082

The anode of the 3-500Z operates at a visibly red color at its maximum rated dissipation of 500 watts.

In all cases, air flow rates in excess of the minimum requirements will prolong tube life. NOTE: Two 3-500Z tubes in a single amplifier, chassis mounted, may be adequately cooled by use of a fan so mounted as to pressurize the space below the sockets. Fans suitable for use at or near sea level are Pamotor Model 2000, or Model 6500. The Rotron "Spartan" fan (3200 rpm) is also suitable, as is a #3, 3-inch squirrel cage blower (3100 rpm).

In all cases, the only criteria of proper cooling is the temperature of the tube seals. Tube temperatures may be measured with the aid of temperature sensitive paint, spray, or crayon. Suitable products are manufactured by the Tempil Division, Big Three Industrial Gas & Equipment Co., Hamilton Blvd., So. Plainfield, N.J. 07080.

ZERO-BIAS OPERATION - Operation at zero-bias is not recommended with plate voltages over 3000 since plate dissipation may be exceeded. A zener diode placing positive bias on the cathode or other constant voltage source may be used to reduce zero signal plate current at plate potentials over 2500 volts.

CLASS-C OPERATION - Although specifically designed for linear amplifier service, the 3-500Z may be operated as a class-C power amplifier or oscillator or as a plate-modulated radio-frequency power amplifier. The zero-bias characteristic of the 3-500Z can be used to advantage in class-C amplifiers operating at plate voltages of 3000 volts or below by employing only grid-resistor bias. If driving power fails, plate dissipation is then kept to a low value because the tube will be operating at the normal static zero-bias conditions.

ELECTRICAL

FILAMENT OPERATION - The rated filament voltage for the 3-500Z is 5.0 volts. Filament voltage, as measured at the socket, must be maintained within the range of 4.75 to 5.25 volts to obtain maximum tube life.

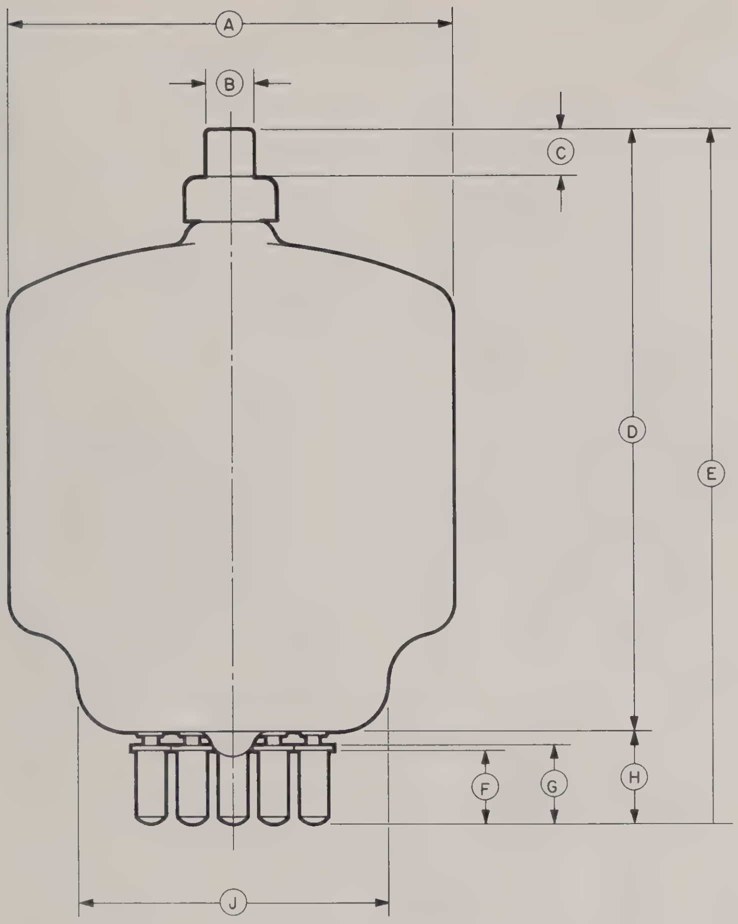
CAUTION-HIGH VOLTAGE - Operating voltage for the 3-500Z can be deadly, so the equipment must be designed properly and operating precautions must be followed. Design equipment so that no one can come in contact with high voltages. All equipment must include safety enclosures for high voltage circuits and terminals, with interlock switches to open the primary circuits of the power supply and to discharge high voltage capacitors whenever access doors are opened. Interlock switches must not be bypassed or "cheated" to allow operation with access doors open. Always remember that HIGH VOLTAGE CAN KILL.

INTERMODULATION DISTORTION - Typical operating conditions with distortion values included are the result of data taken during actual operation at 2 megahertz. Intermodulation values listed are those measured at the full peak envelope power noted.

INPUT CIRCUIT - When the 3-500Z is operated as a grounded-grid rf amplifier, the use of a resonant tank in the cathode circuit is recommended in order to obtain greatest linearity and power output. For best results with a single-ended amplifier it is suggested that the cathode tank circuit operate at a Q of two or more.

SPECIAL APPLICATIONS - If it is desired to operate this tube under conditions widely different from those given here, write to Power Crid Tube Division, EIMAC Division of Varian, 301 Industrial Way, San Carlos, California 94070 for information and recommendation.

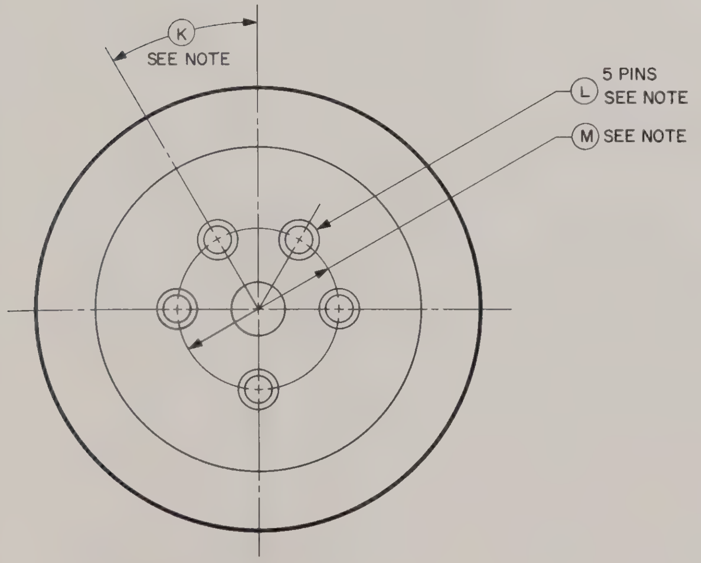
3-500Z OUTLINE DRAWING AND PIN CONNECTIONS

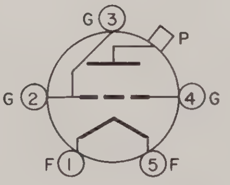


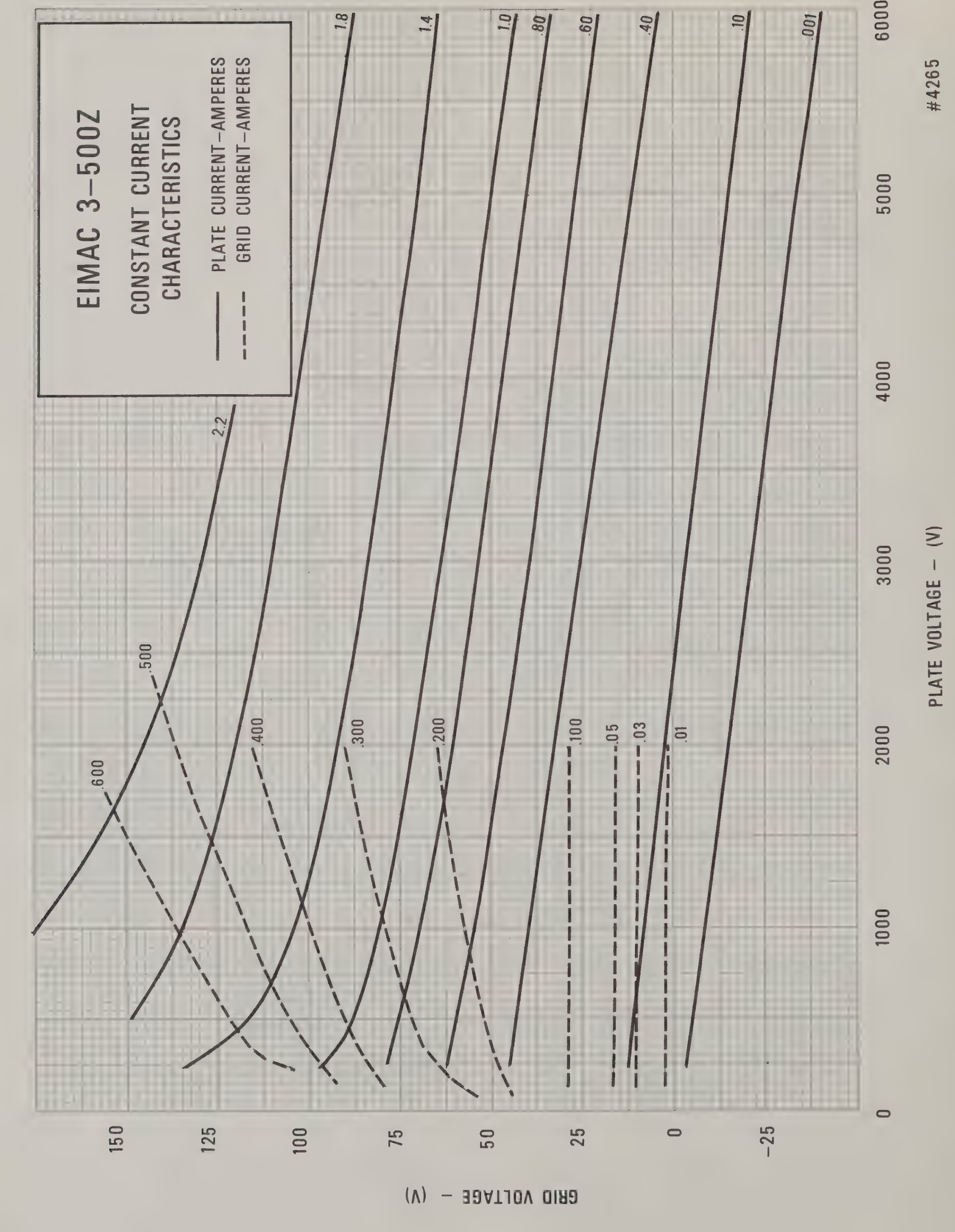
DIMENSIONAL DATA						
DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	--	3.438	--	--	87.33	--
B	--	--	0.355D	--	--	9.02
C	--	--	0.355	--	--	9.02
D	--	--	4.844	--	--	123.04
E	5.500	6.000	--	139.70	152.40	--
F	0.675	0.750	--	17.15	19.05	--
G	0.688	0.813	--	17.48	20.65	--
H	--	--	0.906	--	--	23.01
J	--	2.500D	--	--	63.50	--
K	--	--	30° TYP.	--	--	30° TYP.
L	0.185D	0.191D	--	4.70	4.85	--
M	--	--	1.250D	--	--	31.75D

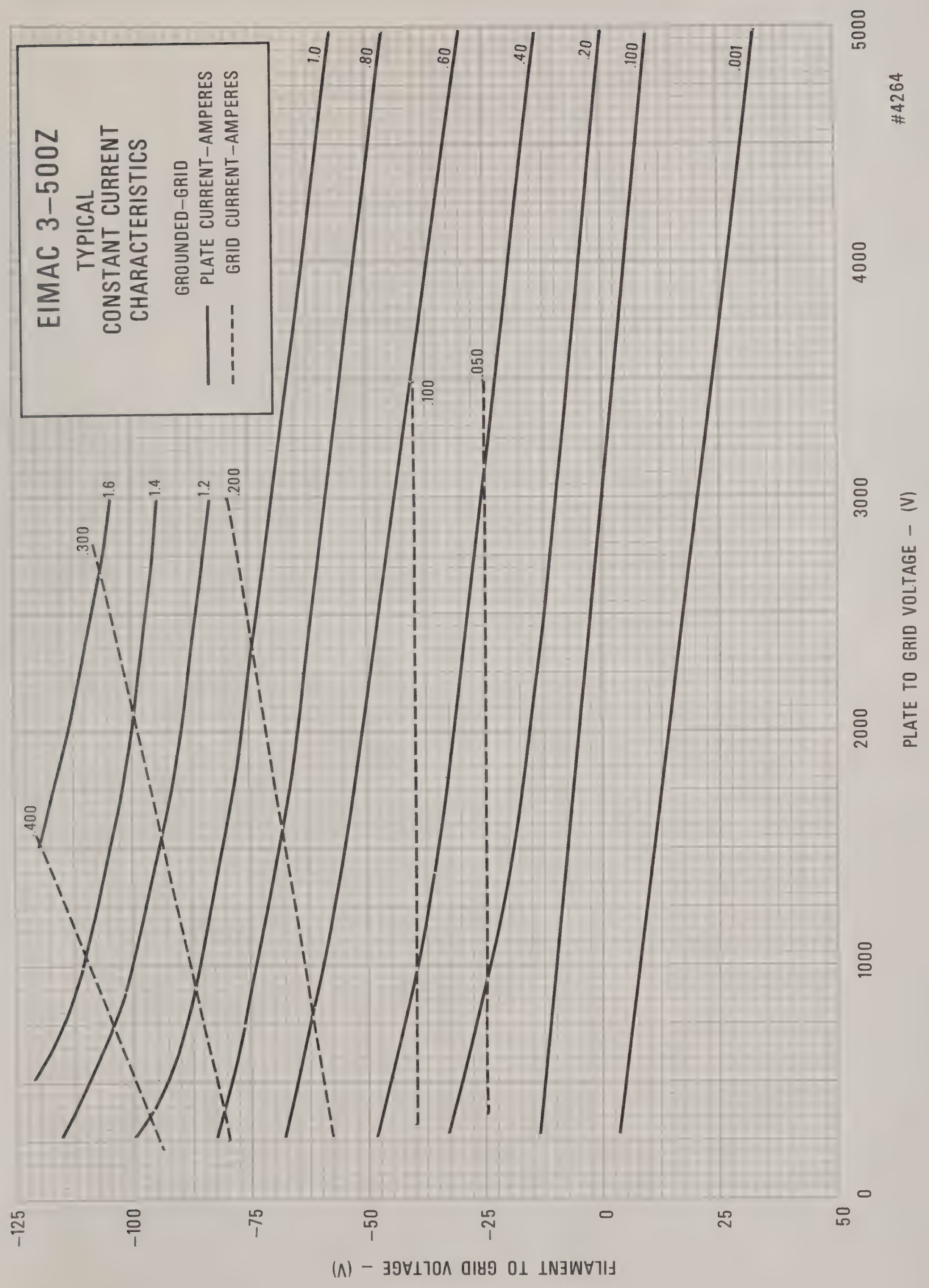
NOTE

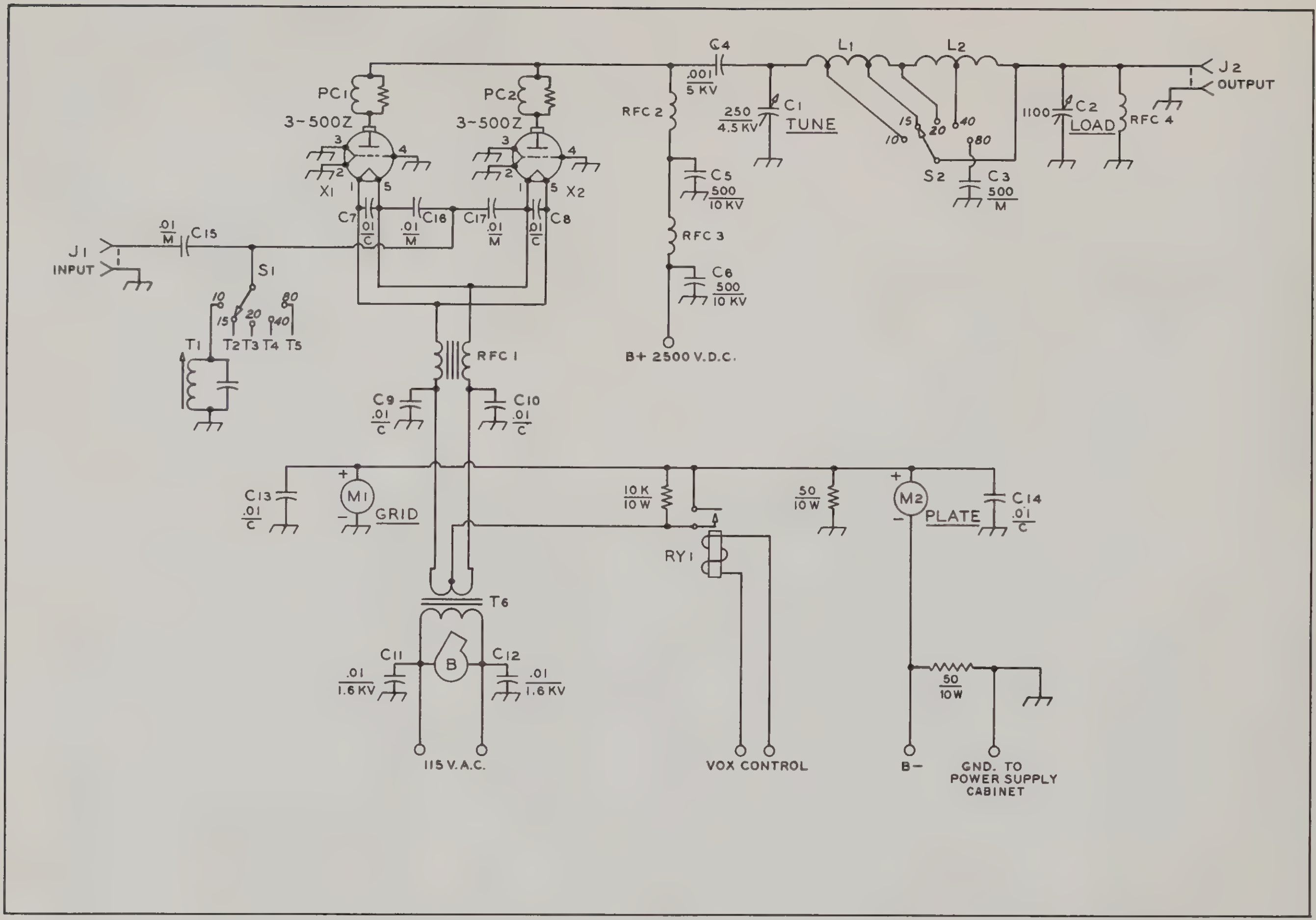
BASE PINS (L)
THEY CAN BE FREELY INSERTED INTO A GAUGE ¼" THICK WITH HOLE DIA'S OF .204 LOCATED ON TRUE CENTERS BY THE GIVEN DIMENSIONS (K) & (M).






EIMAC 3–500Z
CONSTANT CURRENT CHARACTERISTICS
PLATE CURRENT–AMPERES
GRID CURRENT–AMPERES
2.2
1.8
1.4
1.0
.80
.60
.40
.10
.001
.600
.500
.400
.300
.200
.100
.05
.03
.01
GRID VOLTAGE – (V)
150
125
100
75
50
25
0
-25
PLATE VOLTAGE – (V)
0
1000
2000
3000
4000
5000
6000
#4265


EIMAC 3–500Z
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
GROUNDED–GRID
PLATE CURRENT–AMPERES
GRID CURRENT–AMPERES
1.6
1.4
1.2
1.0
.80
.60
.40
.20
.100
.001
.400
.300
.200
.100
.050
FILAMENT TO GRID VOLTAGE – (V)
-125
-100
-75
-50
-25
0
25
50
PLATE TO GRID VOLTAGE – (V)
0
1000
2000
3000
4000
5000
#4264



TYPICAL CATHODE DRIVEN (GROUNDED GRID) AMPLIFIER CIRCUIT FOR TWO 3-500Z TUBES

C-1--250 pF, 4.5 kV (Johnson 154-16).

C-2--1100 pF, 3 section. Jackson Bros. LE-3-4595-380. (M. Swedgal, 258 Broadway, N.Y. 10007).

C-3--500 pF, 2.5 kV mica. Sangamo H-5347.

C-4--.001 μF, 5 kV. Centralab 858S-1000.

C-5, C-6--500 pF, 10 kV, TV "door knob" capacitor.

C-7 thru C-10--.01 μF, 600V ceramic capacitor (Centralab DD-103).

C-11, C-12--.01 μF, 1.6 kV ceramic capacitor (Centralab DD16-103).

C-13, C-14--.01 pF, 600V ceramic capacitor (Centralab DD-103).

C-15 thru C-17--.01 μF, 1 kV mica capacitor (Sangamo H-2210).

M-1--500 mAdc.

M-2--1000 mAdc.

RFC-1--50 μH. 14 bifilar turns #10 AWG enamelled wire wound on ferrite core, 5 inches long, ½ inch diameter. (Indiana General CF-503. Newark Electronics Co. catalog number 59F-1521). Notch core with file and break to length.

RFC-2--100 μH, 1 Adc. 112 turns #26 AWG, spacewound wire diameter on 1" diam., 6" long ceramic form (Centralab X-3022H insulator). Series resonant with terminals shorted to 24.5 MHz.

RFC-3--1.7 μH, 1 Adc. 20 turns #26 AWG wound on 100K, 2W resistor (J.W. Miller RFC-144).

RY-1--VOX operated SPST relay. Energized when transmit.

PC-1, PC-2--Three 100 ohm, 2W carbon resistors in parallel. Three turns #14 AWG, ½" diam., ¾" long in parallel with resistors. (Equivalent: Ohmite P-300 reduced to 3 turns).

J-1, J-2--Coaxial receptacle. UG-58A/U, for type N connector.

T-6--5 v at 30 amp. Chicago-Stancor P-4648.

X-1, X-2--EIMAC SK-410 socket and EIMAC SK-406 chimney.

B-Blower--13 cubic feet at 0.2 inch back pressure. Use #3 impeller at 3100 rpm. (Ripley 8472, Dayton 1C-180 or Redmond AK-2H-01AX).

CATHODE CIRCUIT COMPONENTS:

T-1 (10 meters)--0.15 μH. 4 turns #14 AWG on ½-inch form, ½-inch long. Parallel capacitance: 200 pF, 1 kV silver mica capacitor. Resonant at 28.7 MHz.

T-2 (15 meters)--0.15 μH, same as T-1. Resonant at 21.3 MHz with 470 pF, 1 kV silver mica capacitor.

T-3 (20 meters)--0.31 μH. 6 turns #14 AWG on ½-inch form, ½-inch long, slug tuned (National XR-50). Resonant at 14.2 MHz with 470 pF, 1 kV silver mica capacitor.

T-4 (40 meters)--0.31 μH, same as T-3. Resonant at 7.2 MHz with 940 pF. (Two 470 pF, 1 kV silver mica capacitors in parallel).

T-5 (80 meters)--1.3 μH. 13 turns #18 AWG on ½-inch diameter form, ½-inch long, slug tuned (National XR-50). Resonant at 3.8 MHz with 940 pF, same as T-4.

PLATE CIRCUIT COMPONENTS (for plate potential of 2500 Vdc), $R_L = 1725\Omega$:

The 10, 15 and 20 meter inductor (L_1) may be 10½ turns #8 AWG copper wire (or 3/16" tubing) 2" diam., 3" long. Ten meter tap is 5¼ turns from plate end; 15 meter tap is 7¼ turns from plate end. The 40-80 meter coil (L_2) may be 16 turns #10 AWG, 2½" diam., 4" long. Forty meter tap is 8 turns from junction with coil L-1.

S-2--Single pole ceramic switch, high voltage, 30° index. Radio Switch Corp. Model 86-A.

NOTE: For additional data on plate circuit design, write for Amateur Service Bulletin #30, "Pi and Pi-L Networks for Linear Amplifier Service"

NOTE: B- of power supply is floating and grounded only through plate meter M_2 and the 50 ohm safety resistor. Cabinet of power supply should be grounded to amplifier cabinet as safety measure.

Eimac®

EITEL-McCULLOUGH, INC.
SAN CARLOS, CALIFORNIA

TENTATIVE DATA

8164
3-1000Z
HIGH-MU POWER TRIODE

The Eimac 8164/3-1000Z is a compact power triode intended to be used as a zero-bias Class-B amplifier in audio or radio-frequency applications. Operation with zero grid bias simplifies associated circuity by eliminating the bias supply. In addition, grounded-grid operation is attractive since a power gain as high as twenty times can be obtained with the 8164/3-1000Z in a cathode driven circuit.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament:	Thoriated Tungsten		
	Voltage	7.5	volts
	Current	21.3	amperes
	Amplification Factor (Average)	200	
Interelectrode Capacitances (Average):†			
	Grid-Filament	17.0	uuf
	Grid-Plate	6.9	uuf
	Plate-Filament	0.12	uuf
Frequency for Maximum Ratings		110	Mc

MECHANICAL

Base		5 Pin Special
Basing		See Drawing
Mounting Position		Vertical, base down or up
Cooling		Radiation and forced air
Recommended Heat-Dissipating Plate Connector		Eimac HR-8
▶ Recommended Socket		Eimac SK-510
Recommended Chimney		Eimac SK-516
Maximum Operating Temperatures:		
	Plate Seal	225°C
	Base Seals	200°C
▶ Maximum Over-all Dimensions:		
	Height	7.88 inches
	Diameter	5.25 inches
Net Weight		1.2 pounds

†In Shielded Fixture

change from sheet dated 3-15-61

▶ Indicates change from sheet dated 3-15-61

(Effective 3-20-62) Copyright 1962 by Eitel-McCullough, Inc.

R-F LINEAR AMPLIFIER GROUNDED-GRID, CLASS B

MAXIMUM RATINGS

D-C PLATE VOLTAGE	3000 MAX.	VOLTS
D-C PLATE CURRENT	0.800 MAX.	AMP
PLATE DISSIPATION	1000 MAX.	WATTS
GRID DISSIPATION	50 MAX.	WATTS

TYPICAL OPERATION (Single-Tone Conditions)

D-C Plate Voltage	3000	volts
Zero-Sig D-C Plate Current*	240	ma
Max-Sig D-C Plate Current	670	ma
Max-Sig D-C Grid Current	300	ma
Driving Impedance	55	ohms
Resonant Load Impedance	2650	ohms
Max-Sig Driving Power	65	watts
Peak Envelope Plate Output Power	1360	watts

TYPICAL OPERATION (Minimum Distortion Products)

D-C Plate Voltage	2500	volts
Zero-Sig D-C Plate Current*	162	ma
Single-Tone D-C Plate Current	800	ma
Single-Tone D-C Grid Current	254	ma
Two-Tone D-C Plate Current	550	ma
Two-Tone D-C Grid Current	147	ma
Peak Envelope Useful Output Power	1050	watts
Resonant Load Impedance	1700	ohms

Intermodulation Distortion Products - 35 db or more below PEP level

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AUDIO FREQUENCY AMPLIFIER OR MODULATOR, CLASS-B

MAXIMUM RATINGS (PER TUBE)

D-C PLATE VOLTAGE	3000 MAX.	VOLTS
D-C PLATE CURRENT	0.800 MAX.	AMP
PLATE DISSIPATION	1000 MAX.	WATTS
GRID DISSIPATION	50 MAX.	WATTS

TYPICAL OPERATION (Sinusoidal Wave, Two Tubes, Grid Driven)

D-C Plate Voltage	3000	volts
D-C Grid Voltage	0	volts
Zero-Sig D-C Plate Current*	480	ma
Max-Sig D-C Plate Current	1340	ma
Max-Sig D-C Grid Current	480	ma
Driving Power	42	watts
Peak A-F Driving Voltage (per tube)	88	volts
Load Resistance, Plate-to-Plate	4850	ohms
Max-Sig Plate Output Power	2570	watts

*Approximate Value

NOTE: In most cases, "TYPICAL OPERATION" data are obtained by calculation from published characteristic curves and confirmed by direct tests. No allowance for circuit losses, either input or output, has been made. Exceptions are distinguished by a listing of "Useful" output power as opposed to "Plate" output power. Values appearing in these groups have been obtained from existing equipment(s) and the output power is that measured at the load.

APPLICATION

MOUNTING -- The 3-1000Z must be operated vertically, base up or base down. A flexible connecting strap should be provided between the Eimac HR-8 cooler on the plate terminal and the external plate circuit. The tube must be protected from severe vibration and shock.

▶ COOLING -- Forced-air cooling is required to maintain the base seals at a temperature below 200°C, and the plate seal at a temperature below 225°C. When using the Eimac SK-510 Air-System Socket and SK-516 Chimney, a minimum air flow rate of 25 cubic feet per minute at a static pressure of approximately 0.38 inch of water, as measured at the socket at sea level, is required to provide adequate cooling at an inlet air temperature of 50°C. Above 30 megacycles the required air flow rate is increased to 35 cubic feet per minute at a static pressure of approximately 0.75 inch of water, as measured at the SK-510 socket. Cooling air must be supplied to the tube even when the filament alone is on during standby periods.

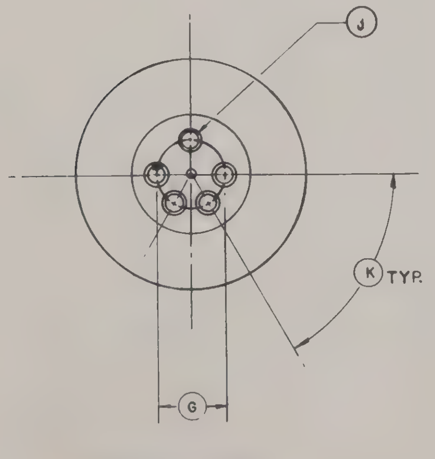
When a socket other than the SK-510 is used, provisions must be made for equivalent cooling of the base, the envelope, and the plate seal. In all cases, air flow rates in excess of the minimum requirements will prolong tube life.

FILAMENT OPERATION -- The rated filament voltage for the 3-1000Z is 7.5 volts. Filament voltage, as measured at the socket, must be maintained within the range of 7.13 to 7.87 volts to obtain maximum tube life.

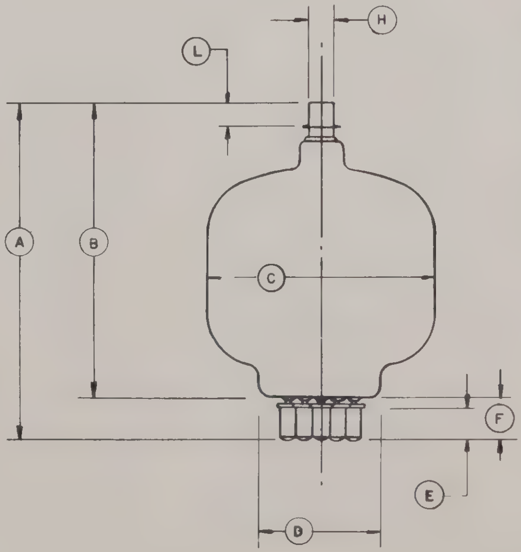
INTERMODULATION DISTORTION -- Typical Operating conditions with distortion values included are the result of data taken during actual operation at 2 megacycles. Intermodulation values listed are those measured at the full peak envelope power noted. As the driving signal level is reduced, distortion products remain at the listed value, or better, below original peak envelope power level.

INPUT CIRCUIT -- When the 3-1000Z is operated as a grounded-grid r-f amplifier, the use of a resonant tank in the cathode circuit is recommended in order to obtain greatest linearity and power output. For best results with a single-ended amplifier it is suggested that the cathode tank circuit operate at a "Q" of five or more.

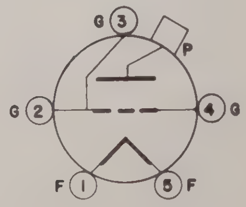
SPECIAL APPLICATIONS -- If it is desired to operate this tube under conditions widely different from those given here, write to Power Grid Tube Marketing, Eitel-McCullough, Inc., 301 Industrial Way, San Carlos, California, for information and recommendations.



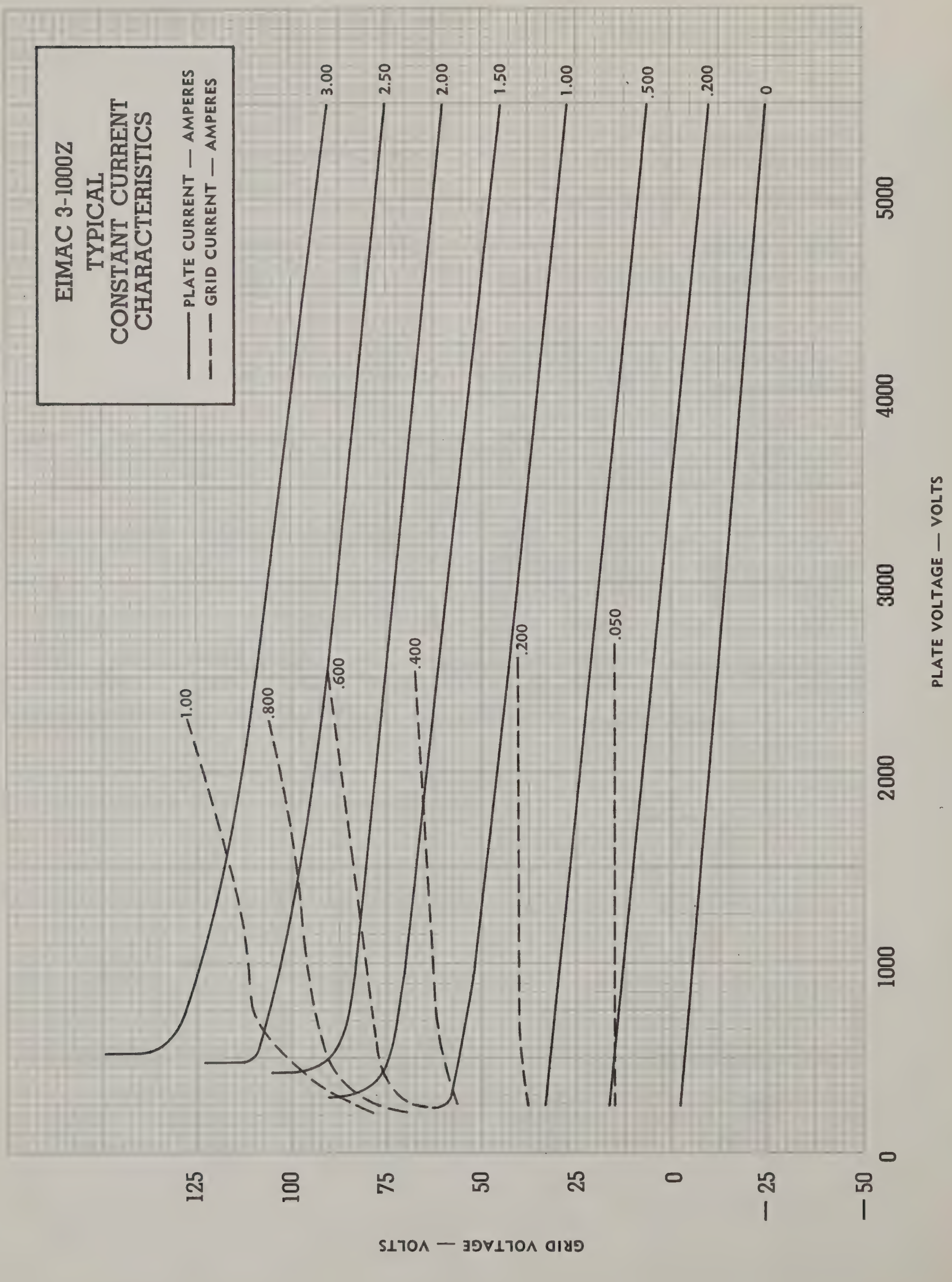
BOTTOM VIEW



REF	MIN.	NOM.	MAX.
A	7 1/2		7 7/8
B	6 11/16		7 1/16
C			5 1/4
D	2 3/4		2 7/8
E	17/32		21/32
F	25/32		29/32
G		1.500	
H	.559		.573
J	.371		.377
K		60°	
L	.540		.560



▶ Indicates change from sheet dated 3-15-61


EIMAC 3-1000Z
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
PLATE CURRENT — AMPERES
GRID CURRENT — AMPERES
3.00
2.50
2.00
1.50
1.00
.500
.200
0
1.00
.800
.600
.400
.200
.050
125
100
75
50
25
0
— 25
— 50
GRID VOLTAGE — VOLTS
0
1000
2000
3000
4000
5000
PLATE VOLTAGE — VOLTS

Eimac®

EITEL-McCULLOUGH, INC.
SAN CARLOS, CALIFORNIA

3C24

MEDIUM-MU TRIODE
•
MODULATOR
OSCILLATOR
AMPLIFIER

The Eimac 3C24 is a medium-mu, power triode intended for use as an amplifier, oscillator or modulator. It has a maximum plate dissipation rating of 25 watts and can be operated at its maximum ratings at frequencies up to 60 megacycles.

The 3C24 is cooled by radiation from the plate and by air circulation around the envelope. The plate operates at a visible red color at maximum rated dissipation.

This tube is identical to the 25T except that the grid terminal is located at the side of the envelope instead of the base.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated tungsten	
Voltage	6.3 volts
Current	3.0 amperes
Amplification Factor (Average)	24
Direct Interelectrode Capacitances (Average)	
Grid-Plate	1.6 μμf
Grid-Filament	1.7 μμf
Plate-Filament	0.2 μμf
Transconductance (i_b=25 ma., E_b=1000 v.)	2500 μmhos
Frequency for Maximum Ratings	60 Mc.

MECHANICAL

Base	UX Small 4-pin
Basing - Fits E. F. Johnson Co. No. 122-224, National Co. No. XC-4 or CIR-4, or equivalent socket	
Mounting	Vertical, base down or up
Cooling	Convection and Radiation
Recommended Heat Dissipating Connector:	
Plate	HR-1
Grid	HR-1
Maximum Over-all Dimensions:	
Length	4.38 inches
Diameter	1.44 inches
Net Weight	1.5 ounces
Shipping Weight (Average)	1.0 pound

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class-B and AB

MAXIMUM RATINGS, PER TUBE

D-C PLATE VOLTAGE	2000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT	75 MAX. MA.
PLATE DISSIPATION	25 MAX. WATTS
GRID DISSIPATION	7 MAX. WATTS

TYPICAL OPERATION, CLASS AB_2
Sinusoidal wave, two tubes unless otherwise specified

D-C Plate Voltage	750	1000	1250	Volts
D-C Grid Voltage (approx.)*	—20	—30	—42	Volts
Zero-Signal D-C Plate Current	43	32	24	Ma.
Max-Signal D-C Plate Current	127	127	130	Ma.
Effective Load, Plate-to-Plate	12,000	17,000	21,400	Ohms
Peak A-F Grid Input Voltage (per tube)	110	120	135	Volts
Max-Signal Peak Driving Power	5.5	6.0	6.8	Watts
Max-Signal Nominal Driving Power (approx.)	2.8	3.0	3.4	Watts
Max-Signal Plate Power Output	60	85	112	Watts

*Adjust to give stated zero-signal plate current.

PLATE MODULATED RADIO FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	1600 MAX. VOLTS
D-C PLATE CURRENT	60 MAX. MA.
PLATE DISSIPATION	17 MAX. WATTS
GRID DISSIPATION	7 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	1000	1250	1600	Volts
D-C Plate Current	60	60	53	Ma.
D-C Grid Voltage	—120	—140	—170	Volts
D-C Grid Current	14	13	11	Ma.
Peak R-F Grid Input Voltage	235	255	280	Volts
Driving Power	3.3	3.3	3.1	Watts
Grid Dissipation	1.6	1.5	1.2	Watts
Plate Power Input	60	75	85	Watts
Plate Dissipation	13	15	17	Watts
Plate Power Output	47	60	68	Watts

The above figures show actual measured tube performance and do not allow for variations in circuit losses.

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony (Key-down conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	2000 MAX. VOLTS
D-C PLATE CURRENT	75 MAX. MA.
PLATE DISSIPATION	25 MAX. WATTS
GRID DISSIPATION	7 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	1000	1500	2000	Volts
D-C Plate Current	72	67	63	Ma.
D-C Grid Voltage	—70	—95	—130	Volts
D-C Grid Current	9	13	18	Ma.
Peak R-F Grid Input Voltage	170	195	245	Volts
Driving Power	1.3	2.2	4.0	Watts
Grid Dissipation	.9	1.3	2.1	Watts
Plate Power Input	72	100	125	Watts
Plate Dissipation	25	25	25	Watts
Plate Power Output	47	75	100	Watts

The above figures show actual measured tube performance and do not allow for variations in circuit losses.

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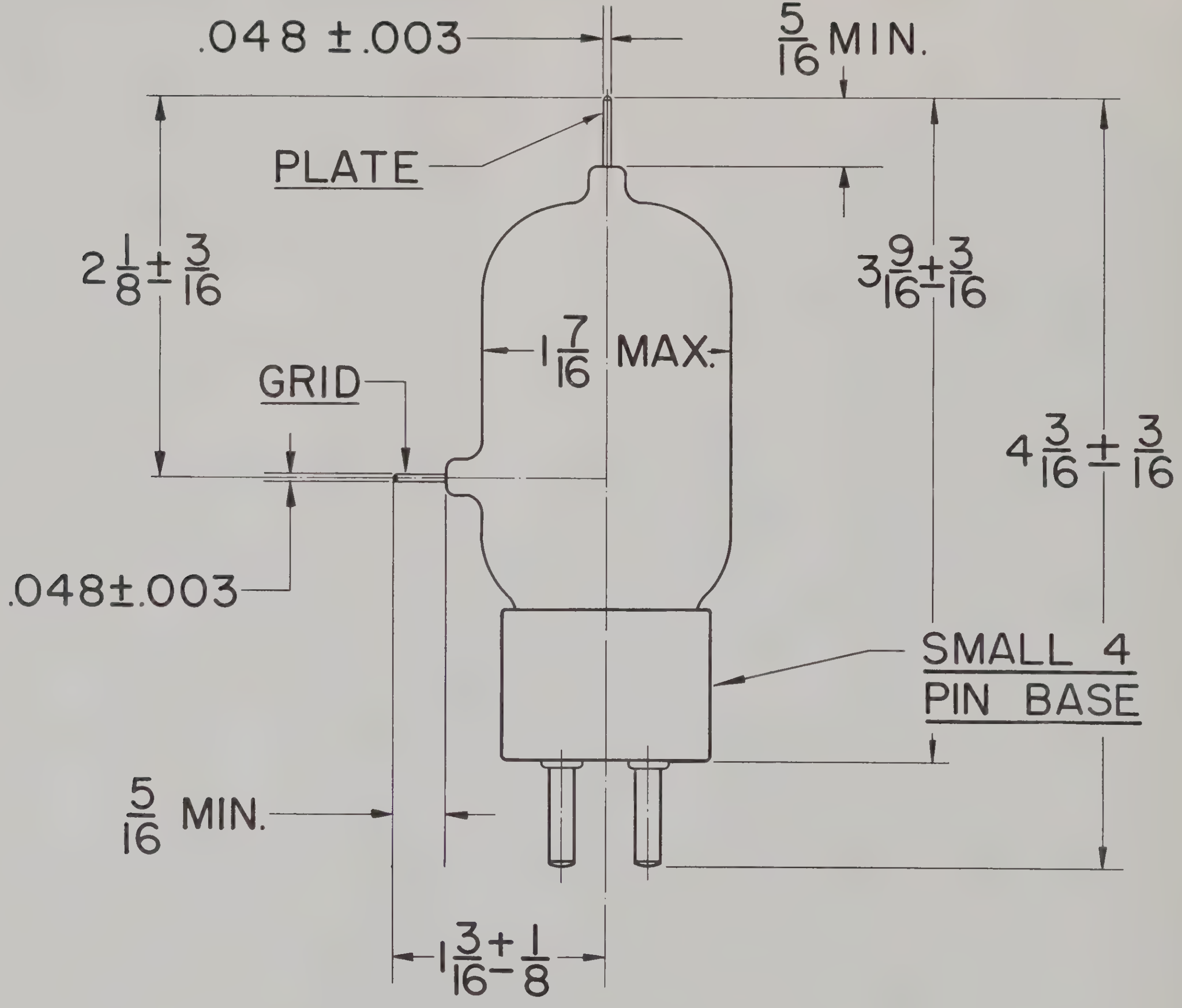
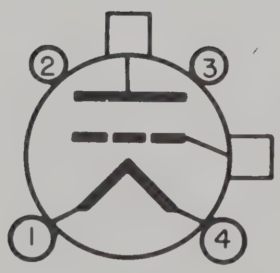
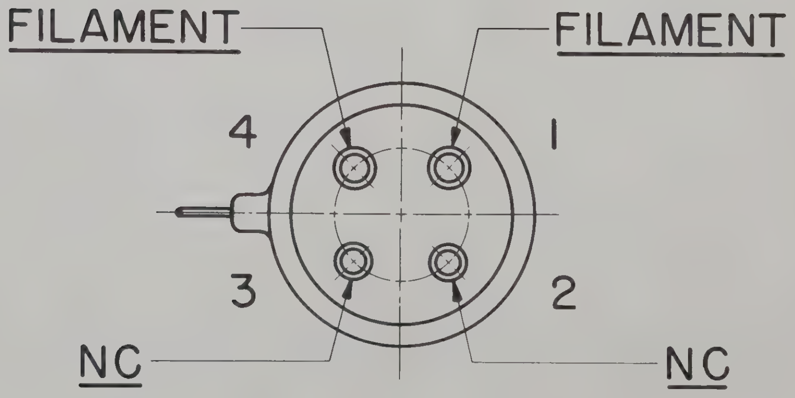

.048 ±.003
5/16 MIN.
PLATE
2 1/8 ± 3/16
3 9/16 ± 3/16
1 7/16 MAX.
GRID
4 3/16 ± 3/16
.048±.003
SMALL 4 PIN BASE
5/16 MIN.
1 3/16 ± 1/8



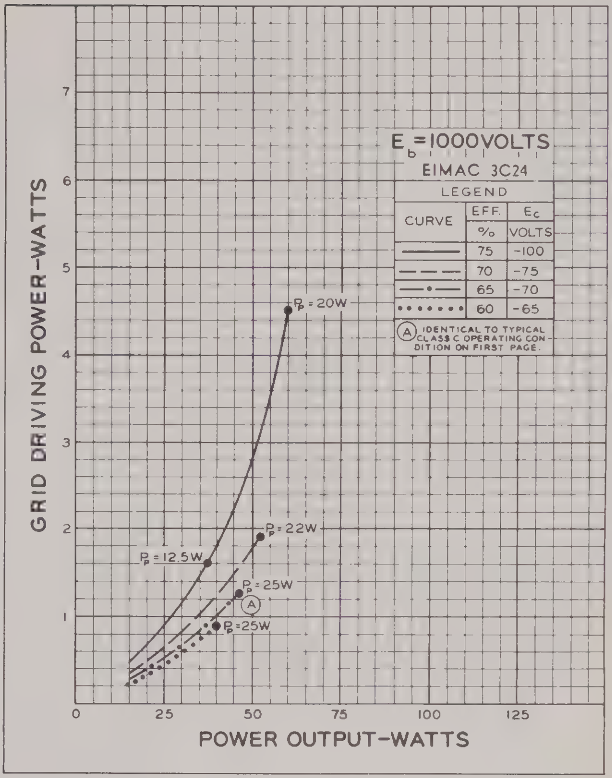

FILAMENT
FILAMENT
4
1
3
2
NC
NC

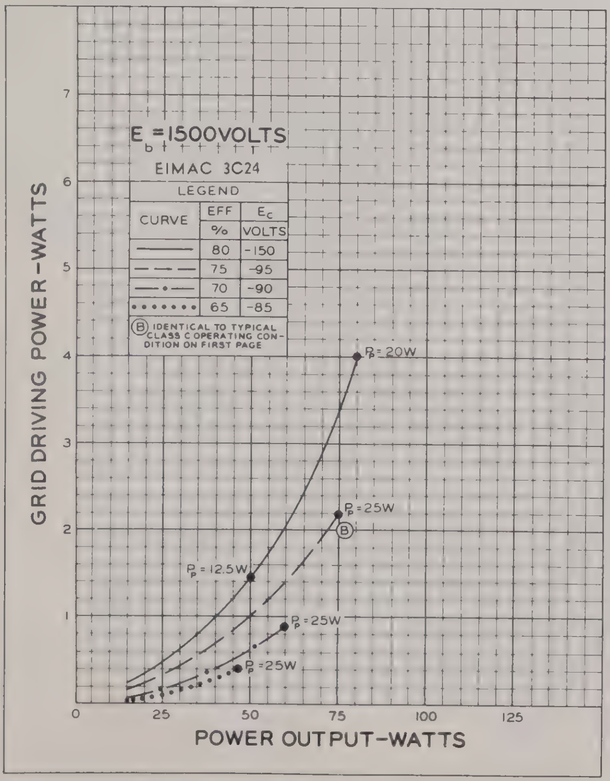
BOTTOM VIEW

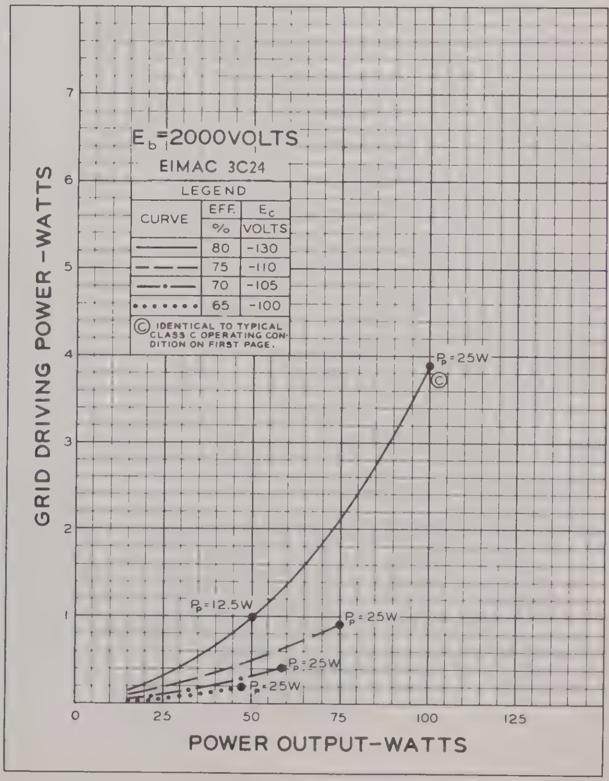
DRIVING POWER vs. POWER OUTPUT

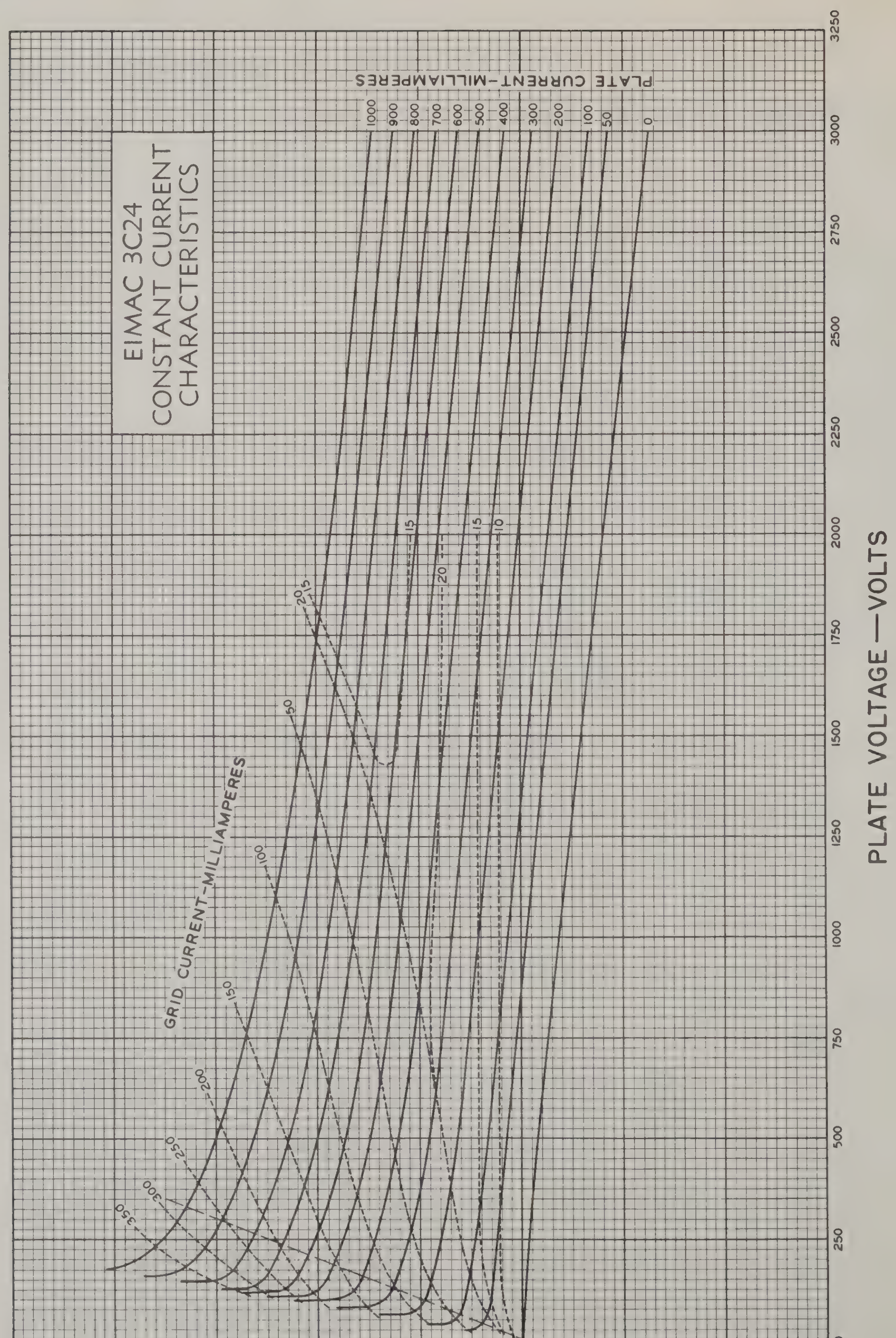
The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 1000, 1500 and 2000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 1000, 1500, and 2000 volts respectively.





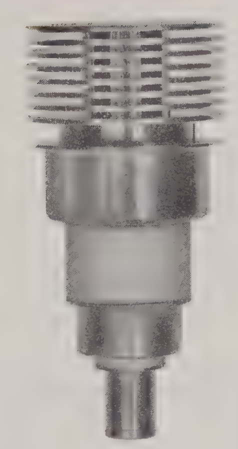


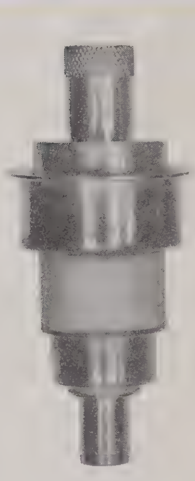

EIMAC 3C24
CONSTANT CURRENT
CHARACTERISTICS
PLATE CURRENT-MILLIAMPERES
1000
900
800
700
600
500
400
300
200
100
50
0
GRID CURRENT-MILLIAMPERES
350
300
250
200
150
100
50
20
15
20
15
15
10
PLATE VOLTAGE — VOLTS
0
250
500
750
1000
1250
1500
1750
2000
2250
2500
2750
3000
3250
GRID VOLTAGE — VOLTS
500
400
300
200
100
0
-100
-200
-300

TECHNICAL DATA

7211 / 7698

PLANAR TRIODES


7211


7698

The EIMAC 7211 and 7698 are rugged ceramic/metal planar triodes designed for use in CW, grid- or plate-pulsed oscillator, amplifier or frequency multiplier service up to 3 GHz. The tubes may also be used in pulse modulator or voltage regulator service. The 7211 is normally supplied with an air cooled radiator for forced air cooling, while the 7698 is supplied without radiator and is intended for conduction-convection cooling as found in many pulsed type applications. Except for the plate dissipation ratings and outline, the characteristics of both tube types are identical.

The 7211 and 7698 feature high mu, high transconductance, great mechanical strength and low interelectrode capacitances, as well as high current capability and increased grid-anode insulator length. Both tubes have an arc-resistant, extended interface cathode, well proven in airline applications, assuring reliable and long life operation under adverse conditions.

Note: The data for the 7211 also applies to the EIMAC 7698R in all respects.

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Cathode: Oxide Coated, Unipotential		
Heater: Voltage	6.3 ± 0.3	V
Current, at 6.3 volts	1.30	A
Transconductance (Average):		
I_b= 160 mAdc, (200mA/cm^2)	38	mmhos
Amplification Factor (Average)	80	
Direct Interelectrode Capacitance (grounded cathode)[2], without heater voltage:		
Grid-Cathode	8.0	pF
Grid-Plate	2.25	pF
Plate-Cathode (maximum)	0.06	pF
Cut-off Bias[3] (maximum)	-30	V

[1] Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.

[2] Capacitance values are for a cold tube as measured in a special shielded fixture. When the cathode is heated to the proper temperature, the grid-cathode capacitance will increase from the cold value by approximately 1 pF due to thermal expansion of the cathode.

[3] Measured with one milliampere plate current and a plate voltage of 1 kVdc.

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MECHANICAL

Maximum Overall Dimensions:	
Length	2.701 in; 68.60 mm
Diameter (7698)	1.195 in; 30.35 mm
Diameter (7211)	1.264 in; 32.11 mm
Net Weight (7698)	1.8 oz; 48 gm
Net Weight (7211)	2.2 oz; 63 gm
Operating Position	Any
Maximum Operating Temperature:	
Ceramic/Metal Seals	250°C
Anode Core	250°C
Cooling (7698)	Conduction and Convection
Cooling (7211)	Forced Air
Terminals	Coaxial, special

ENVIRONMENTAL

Shock, 11 ms, non-operating	60 G
Vibration, operating, all axes 55 to 500 Hz	10 G
Altitude, max (in a suitably designed circuit)	70,000 ft.

CW RF POWER AMPLIFIER OR OSCILLATOR

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE	2500	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
Grid negative to cathode	-400	VOLTS
Grid positive to cathode	30	VOLTS
DC PLATE CURRENT	150	MILLIAMPERES
DC GRID CURRENT	45	MILLIAMPERES
AVERAGE PLATE DISSIPATION		
Conduction and Convection (7698)	10	WATTS
Forced Air Cooling[1] (7211)	100	WATTS
GRID DISSIPATION (Average)	2	WATTS
FREQUENCY	2.5	GHz

OPERATING CONDITIONS FOR 7211 AND 7698 IN REPRESENTATIVE APPLICATION

Grounded Grid CW Power Amplifier

Frequency	700	MHz
Heater Voltage	6.3	V
DC Plate Voltage	630	Vdc
DC Grid Voltage (approx)	-5	Vdc
DC Cathode Current	140	mAdc
DC Grid Current	25	mAdc
Drive Power (approx)	4	W
Useful CW Power Output	45	W

Grounded Grid CW Oscillator

Frequency	2.5	GHz
Heater Voltage	5.0	V
DC Plate Voltage	1000	Vdc
DC Grid Voltage (approx)	-20	Vdc
DC Plate Current	140	mAdc
DC Grid Current	30	mAdc
Useful CW Power Output	30	W

[1] Using EIMAC radiator PN 014224.

GRID PULSED OR PLATE PULSED AMPLIFIER OR OSCILLATOR

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE (GRID PULSED)	2500	VOLTS
PEAK PULSE PLATE VOLTAGE (PLATE PULSED)	3500	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
Grid negative to cathode	-700	VOLTS
Grid positive to cathode	250	VOLTS
PULSE PLATE CURRENT	5.0	AMPERES
PULSE GRID CURRENT	2.5	AMPERES
AVERAGE PLATE DISSIPATION		
Conduction and Convection (7698)	10	WATTS
Forced Air Cooling[1] (7211)	100	WATTS
GRID DISSIPATION (Average)	2	WATTS
FREQUENCY	3.0	GHz
PULSE DURATION [2]	6	μs
DUTY FACTOR [2]	.0033	

OPERATING CONDITIONS FOR 7211 AND 7698 IN REPRESENTATIVE APPLICATION

Grid Pulsed Amplifier

Frequency	1.1	GHz
Heater Voltage	6.3	V
DC Plate Voltage	2200	Vdc
DC Grid Voltage	-50	Vdc
Peak Video Plate Current	2.5	a
Peak Video Grid Current	1.0	a
Pulse Drive Power (approx)	400	w
Useful Power Output (approx)	2500	w
Pulse Duration	3	μs
Duty Factor	.002	

Plate Pulsed Oscillator

Frequency	3.0	GHz
Heater Voltage	5.8	V
Peak Plate Voltage	3500	v
Peak Video Plate Current	4.8	a
Peak Video Grid Current	1.5	a
Useful Power Output (approx)	3000	w
Pulse Duration	3	μs
Duty Factor	.0025	

1. Using Eimac radiator PN 014224.
2. For application requiring longer pulse duration and/or higher duty cycle consult the nearest Varian Electron Tube & Devices Field Office, or the Product Manager, EIMAC Division of Varian, Salt Lake City, Utah.

PULSE MODULATOR OR PULSE AMPLIFIER SERVICE

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE	2500	VOLTS
PEAK PLATE VOLTAGE	3500	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
Grid negative to cathode	-700	VOLTS
Grid positive to cathode	150	VOLTS
PULSE CATHODE CURRENT	7.5	AMPERES
DC PLATE CURRENT	150	MILLIAMPERES
AVERAGE PLATE DISSIPATION		
Conduction and Convection (7698)	10	WATTS
Forced Air Cooling[1](7211)	100	WATTS
GRID DISSIPATION (Average)	2	WATTS
PULSE DURATION [2]	6	μs
DUTY FACTOR [2]	.0033	
CUT-OFF MU	60	

1. Using EIMAC radiator PN 014224.
2. For application requiring long pulse duration and/or higher dury cycle consult the nearest Varian Electron Tube & Devices Field Office, or the Product Manager, EIMAC Division of Varian, Salt Lake City, Utah.

RANGE VALUES FOR EQUIPMENT DESIGN

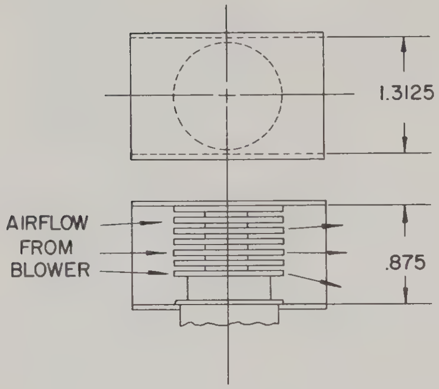
	Min.	Max.	
Heater: Current at 6.3 volts	1.20	1.40	A
Cathode Heating Time	60	---	sec.
Interelectrode Capacitances[1] (grounded cathode connection)			
Grid-Cathode	7.0	9.0	pF
Plate-Cathode	---	0.06	pF
Grid-Plate	2.10	2.40	pF

1. Capacitance values for a cold tube as measured in a special shielded fixture. When the cathode is heated to the proper temperature, the grid-cathode capacitance will increase from the cold value by approximately 1 pF due to thermal expansion of the cathode.

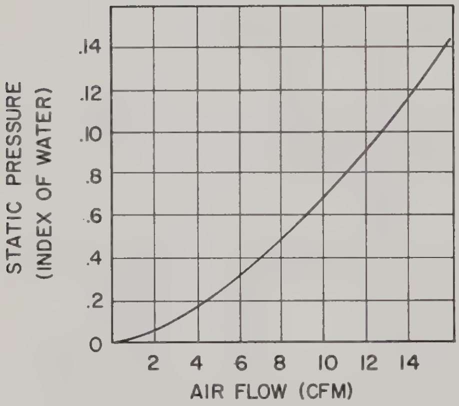
APPLICATION

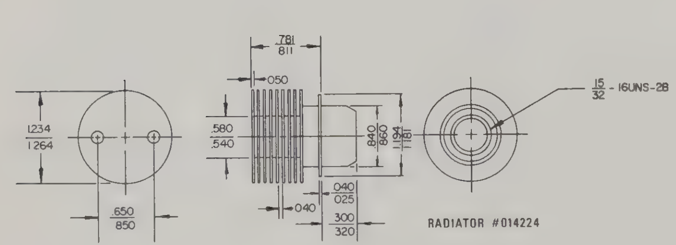
For general application information please refer to the Planar Triode Operating Instruction Sheet. The operating instructions should be consulted prior to the designing of new requirements around the above tube types. Plate dissipation of up to 150 watts is possible with the 7211/7698 tube type when using radiator P/N 158555. If this is required the tube order should include a reference to the different radiator part number. For unusual and special application consult the nearest Varian Electron Tube and Device Field Office, or the Product Manager, EIMAC Division of Varian, Salt Lake, City, Utah.

AIRFLOW vs STATIC PRESSURE WITH STANDARD COWLING JAN-157

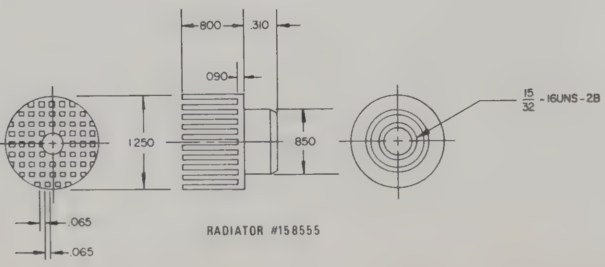


-STANDARD COWLING-





RADIATOR #014224



RADIATOR #158555

MAXIMUM PLATE DISSIPATION vs COOLING AIRFLOW

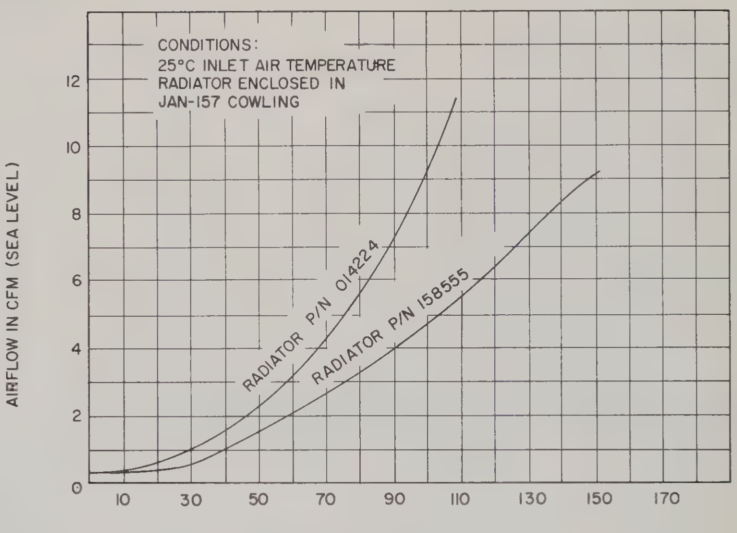
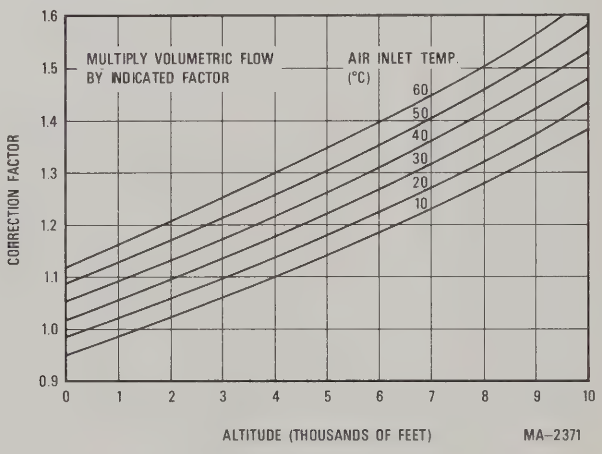


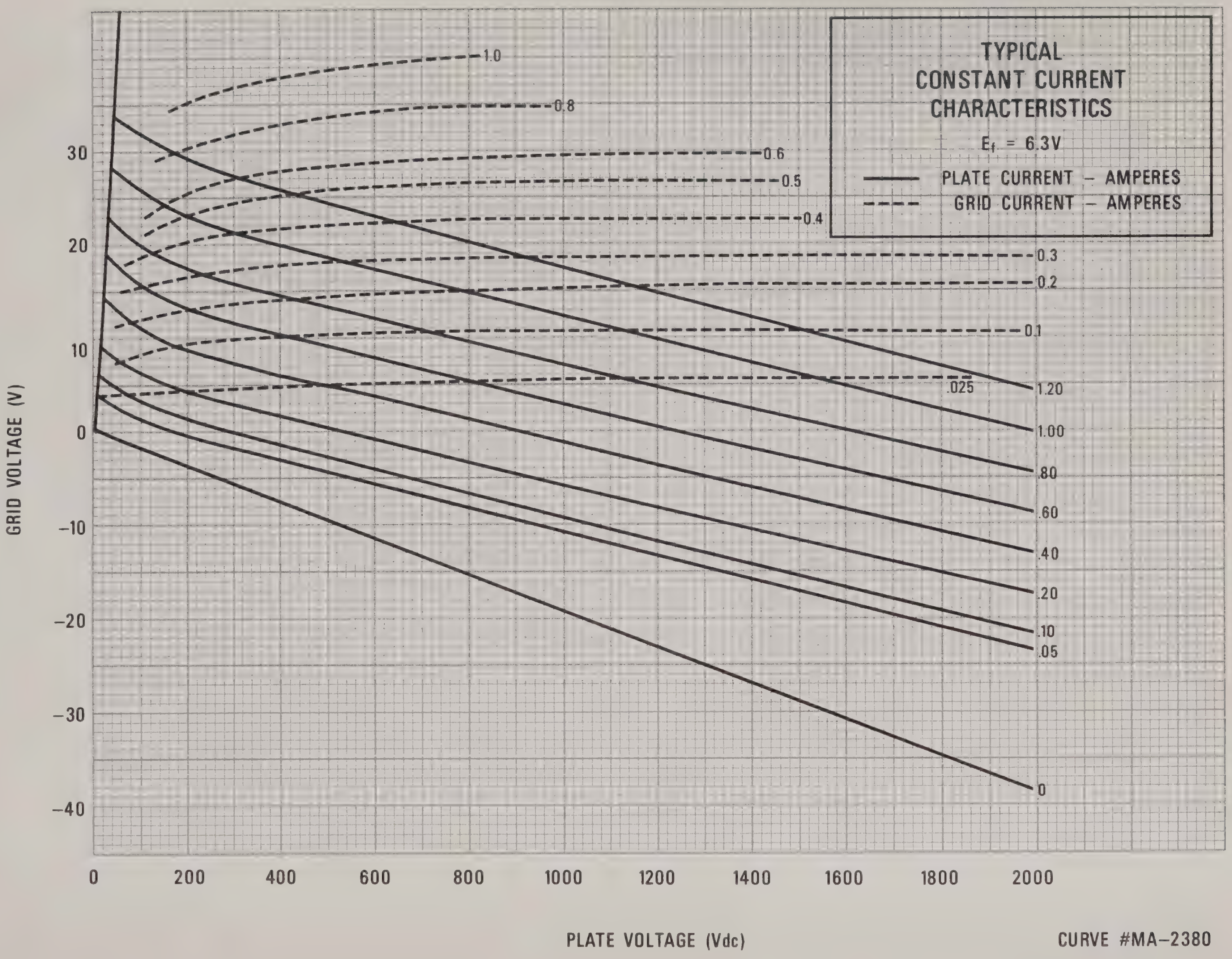
PLATE DISSIPATION IN WATTS

COMBINED CORRECTION FACTORS FOR INLET AIR TEMPERATURE AND ALTITUDE

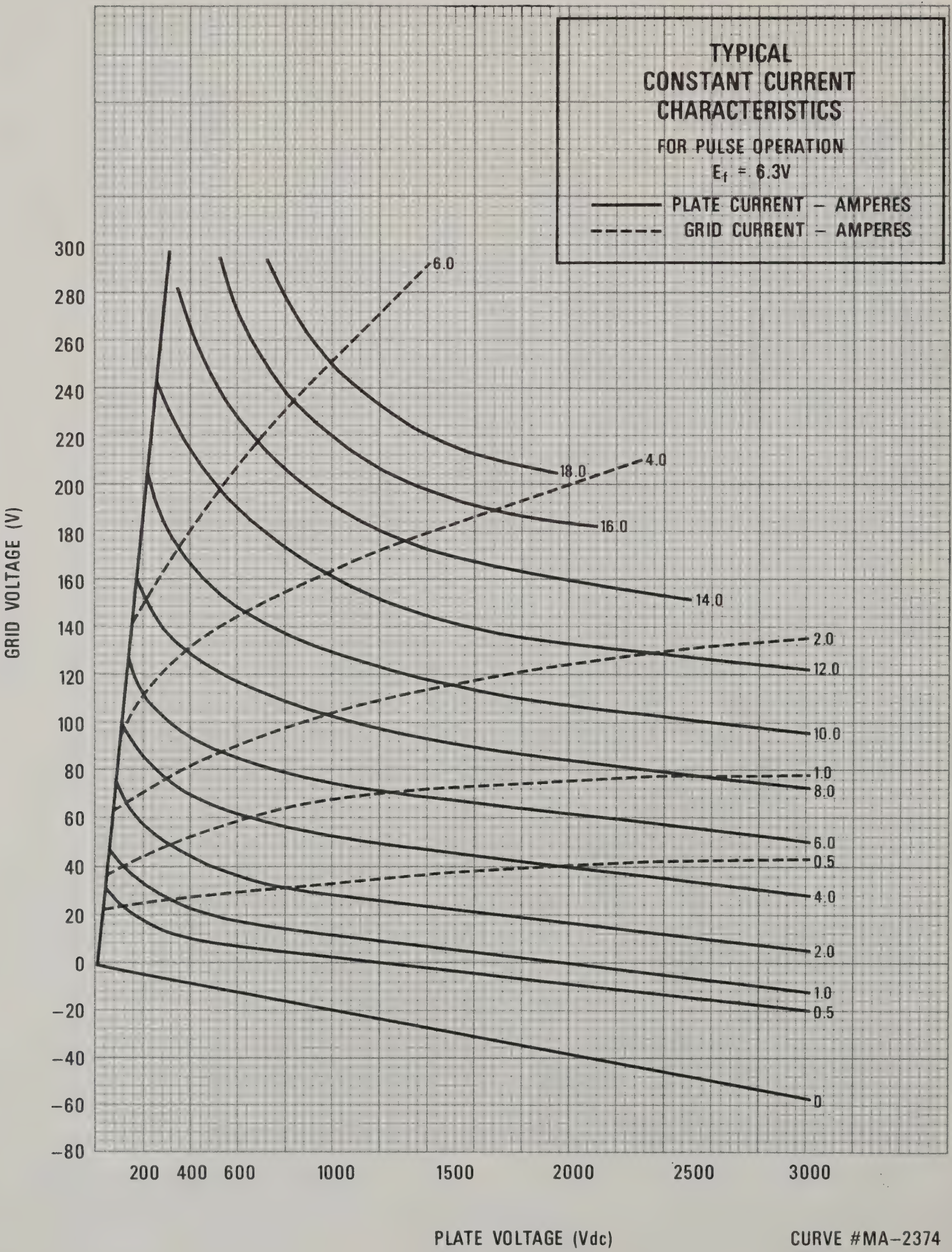
(RELATIVE TO 25°C AND SEA LEVEL)



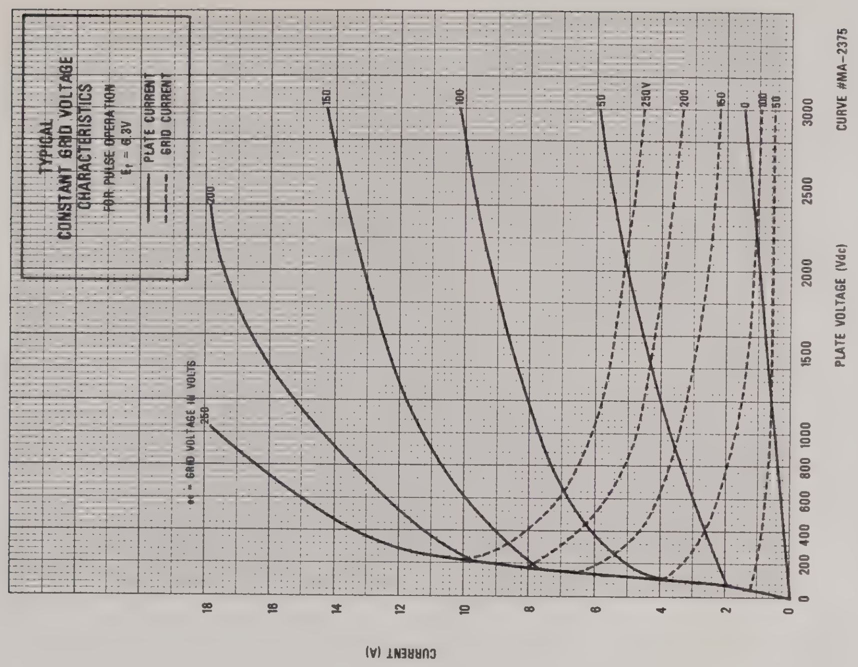
ALTITUDE (THOUSANDS OF FEET) MA-2371

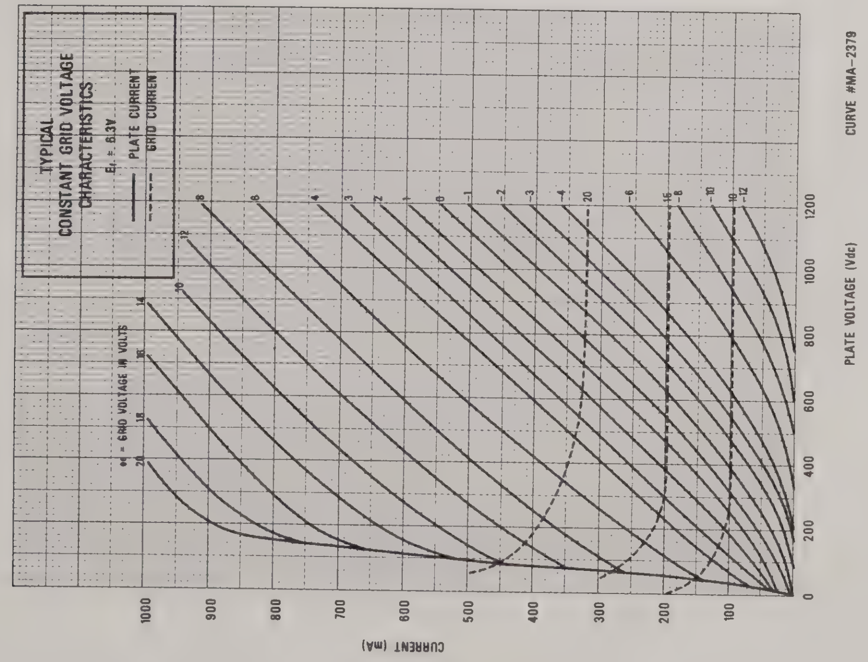


CURVE #MA-2380



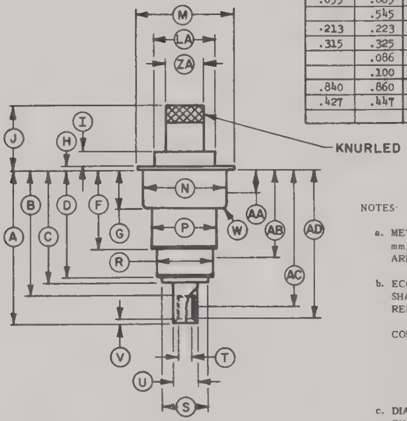
CURVE #MA–2374


TYPICAL
CONSTANT GRID VOLTAGE
CHARACTERISTICS
FOR PULSE OPERATION
E_f = 6.3V
PLATE CURRENT
GRID CURRENT
e_c = GRID VOLTAGE IN VOLTS
250
200
150
100
50
0
250V
200
150
100
50
CURRENT (A)
0
2
4
6
8
10
12
14
16
18
0
200
400
600
800
1000
1500
2000
2500
3000
PLATE VOLTAGE (Vdc)
CURVE #MA-2375


TYPICAL
CONSTANT GRID VOLTAGE
CHARACTERISTICS
E_f = 6.3V
PLATE CURRENT
GRID CURRENT
e_c = GRID VOLTAGE IN VOLTS
20
18
16
14
12
10
8
6
4
3
2
1
0
-1
-2
-3
-4
20
-6
16
-8
-10
10
-12
CURRENT (mA)
100
200
300
400
500
600
700
800
900
1000
0
200
400
600
800
1000
1200
PLATE VOLTAGE (Vdc)
CURVE #MA-2379

ELECTRODE CONTACT AREA				
DIM	MIN.	MAX.	MIN.	MAX.
AA	.035	.361	.89	9.17
AB	1.185	1.265	30.10	32.14
AC	1.534	1.728	38.96	43.89
AD	1.475	1.815	37.47	46.10
	DIM. IN INCHES		DIM. IN MILLIMETERS	

DIMENSION DATA					
DIM. IN INCHES			DIM. IN MILLIMETERS		
MIN.	MAX.	DIM	MIN.	MAX.	NOTES
1.185	1.875	A	46.10	47.62	
	1.534	B		38.96	
	1.475	C		37.46	
1.289	1.329	D	32.74	33.76	
.970	1.010	F	24.64	25.65	
.462	.477	G	11.73	12.12	
	.040	H		1.02	
	.185	I		4.70	
.766	.826	J	19.46	20.98	
1.180	1.195	M	29.97	30.35	
1.025	1.035	N	26.04	26.29	c
.752	.792	P	19.10	20.12	d
.655	.665	R	16.64	16.89	c
	.545	S		13.84	
.213	.223	T	5.41	5.66	c
.315	.325	U	8.00	8.26	c
	.086	V		2.18	
	.100	W		2.54	
.840	.860	LA	21.34	21.84	
.427	.447	ZA	10.75	11.35	



NOTES·

a. METRIC EQUIVALENTS, TO THE NEAREST .01 mm, ARE FOR GENERAL INFORMATION ONLY & ARE BASED UPON 1 inch = 25.4 mm.

b. ECCENTRICITY OF CONTACT SURFACES SHALL BE GAGED FROM CENTER LINE OR REFERENCE & SHALL BE AS FOLLOWS:

CONTACT SURFACE	TIR(MAX)	REFERENCE
ANODE	.020	CATHODE
GRID	.020	CATHODE
HEATER	.012	CATHODE

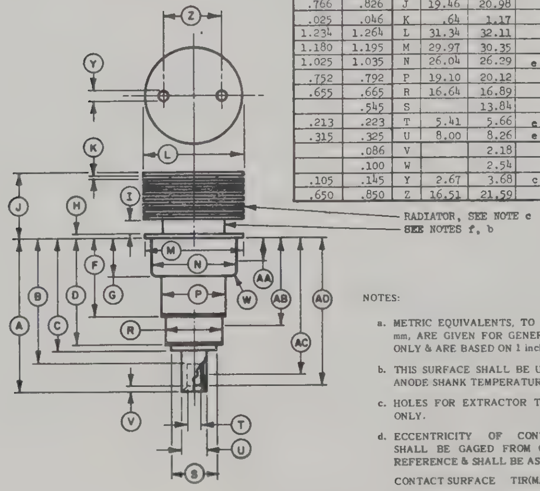
c. DIA'S N, R, T, & U SHALL APPLY THROUGHOUT ENTIRE LENGTH AS DEFINED BY DIM'S AA, AB, AC & AD RESPECTIVELY.

d. THIS SURFACE SHALL NOT BE USED FOR CLAMPING OR LOCATING.

7698

ELECTRODE CONTACT DIMENSION				
DIM	MIN.	MAX.	MIN.	MAX.
AA	.035	.361	.89	9.17
AB	1.185	1.265	30.10	32.14
AC	1.534	1.728	38.96	43.89
AD	1.475	1.815	37.47	46.10
	DIM. IN INCHES		DIM. IN MILLIMETERS	

DIMENSION DATA					
DIM. IN INCHES			DIM. IN MILLIMETERS		
MIN.	MAX.	DIM	MIN.	MAX.	NOTES
1.185	1.875	A	46.10	47.62	
	1.534	B		38.96	
	1.475	C		37.46	
1.289	1.329	D	32.74	33.76	
.970	1.010	F	24.64	25.65	
.462	.477	G	11.73	12.12	
	.040	H		1.02	
.125	.185	I	3.18	4.70	
.766	.826	J	19.46	20.98	
.025	.046	K	.64	1.17	
1.234	1.264	L	31.34	32.11	
1.180	1.195	M	29.97	30.35	
1.025	1.035	N	26.04	26.29	e
.752	.792	P	19.10	20.12	
.655	.665	R	16.64	16.89	
	.545	S		13.84	
.213	.223	T	5.41	5.66	e
.315	.325	U	8.00	8.26	e
	.086	V		2.18	
	.100	W		2.54	
.105	.145	Y	2.67	3.68	c
.650	.850	Z	16.51	21.59	



NOTES:

a. METRIC EQUIVALENTS, TO THE NEAREST .01 mm, ARE GIVEN FOR GENERAL INFORMATION ONLY & ARE BASED ON 1 inch = 25.4 mm.

b. THIS SURFACE SHALL BE USED TO MEASURE ANODE SHANK TEMPERATURE.

c. HOLES FOR EXTRACTOR THROUGH TOP FIN ONLY.

d. ECCENTRICITY OF CONTACT SURFACES SHALL BE GAGED FROM CENTER LINE OF REFERENCE & SHALL BE AS FOLLOWS:

CONTACT SURFACE	TIR(MAX)	REFERENCE
ANODE	.020	CATHODE
GRID	.020	CATHODE
HEATER	.012	CATHODE

e. DIA'S N, R, T & U SHALL APPLY THROUGHOUT ENTIRE LENGTH AS DEFINED BY DIM'S AA, AB, AC & AD RESPECTIVELY.

f. THIS SURFACE SHALL NOT BE USED FOR CLAMPING OR LOCATING.

7211

EITEL-McCULLOUGH, INC.
SAN CARLOS, CALIFORNIA

7815

3CPN10A5

UHF PULSE TRIODE

The Eimac 7815/3CPN10A5 is a low duty pulse rated version of the 3CX100A5 with the anode cooler removed. A longer grid-anode ceramic insulator is incorporated, making the tube useful at high altitude. The nominal plate dissipation rating is 10 watts but may be increased if sufficient cooling is provided. Cooling is accomplished by conduction through a suitable heat sink or convection. Where greater plate dissipation is required, the 7815R/3CPX100A5 should be used.

The tube is usable in pulse applications to 3000 Megacycles. Electrical characteristics except for plate dissipation are similar to the 3CX100A5.

GENERAL CHARACTERISTICS

ELECTRICAL

	Min.	Nom.	Max.	
Cathode: Oxide-coated, Unipotential				
Heating time	60			seconds
Heater:				
Voltage		6.0		volts
Current	0.90		1.05	amperes
Amplification Factor		100		
Transconductance (I b = 70 milliamperes)		25,000		Micromhos

Direct Interelectrode Capacitances	Min.	Max.
Grid-Cathode	5.6	7.0 uuf
Grid-Plate	1.86	2.10 uuf
Plate-Cathode		0.035 uuf
Frequency for Maximum Ratings		3000 Megacycles

MECHANICAL

Terminals	Graduated Cylindrical Surfaces
Maximum Operating Temperatures:	
Ceramic-to-Metal Seals	250°C
Anode Core	250°C
Operating Position	Any
Cooling	Conduction and Convection
Maximum Overall Dimensions:	
Length	2.701 inches
Diameter	1.195 inches
Net Weight	2.0 ounces
Shipping Weight (approx.)	7.0 ounces

PLATE PULSED OSCILLATOR OR AMPLIFIER CLASS-C

MAXIMUM RATINGS

PEAK PULSE PLATE VOLTAGE	3500 MAX. VOLTS
DC GRID VOLTAGE	-150 MAX. VOLTS
PULSE PLATE CURRENT	3.0 MAX. VOLTS
DC CATHODE CURRENT	125 MAX. MA
PULSE GRID CURRENT	1.8 MAX. AMPS
PLATE DISSIPATION (AVG)	10 MAX. WATTS
GRID DISSIPATION (AVG)	2 MAX. WATTS

TYPICAL OPERATION

Pulse Plate Voltage	3500	3500 volts
Pulse Plate Current	3.0	3.0 amps
DC Plate Current (avg)	7.5	9 mA
DC Grid Current (avg)	4.5	3 mA
Pulse Power Output	1600	2000 watts
Frequency	3000	2500 Mc
Pulse Length	3	5 usec
Duty Factor	0.0025	0.003

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GRID PULSED OSCILLATOR OR AMPLIFIER CLASS-C

MAXIMUM RATINGS

DC PLATE VOLTAGE	2000 MAX. VOLTS
DC GRID VOLTAGE	-150 MAX. VOLTS
PULSE PLATE CURRENT	3.0 MAX. AMPS
DC CATHODE CURRENT	125 MAX. MA.
PLATE DISSIPATION (AVG)	10 MAX. WATTS
GRID DISSIPATION (AVG)	2 MAX. WATTS

TYPICAL OPERATION

DC Plate Voltage	1600	1700	volts
DC Grid Voltage	-45	-45	volts
Pulse Plate Current	3.0	1.9	amps
Pulse Grid Current	1.8	1.1	amps
Pulse Power Output	1000	1500	watts
Frequency	3000	1100	Mc
Pulse Length	3	3.5	usec
Duty Factor	0.0025	0.001	

APPLICATION

MECHANICAL

Mounting—The 3CPN10A5 may be operated in any position. It should be firmly held in place by spring-finger collets bearing on the terminal surfaces. In use the tube should seat against the underside of the anode-terminal flange which is on the plane of reference for longitudinal dimensions. In appplications involving severe shock and vibration, the tube may be clamped in place by applying a suitable clamping device to the anode-terminal flange. It is recommended that no other portion of the tube be subjected to clamping forces.

Connections—The terminals are in the form of concentric cylinders of graduated diameters conveniently used with coaxial tuning devices. Spring-fingered collets should be used to make contact with the anode, grid, cathode and heater terminals. Adequate contact area and spring pressure should be provided to minimize heating and to prevent erratic circuit performance at the higher frequencies. Non-contacting or intermittently-contacting collet fingers will cause troublesome circuit behavior, especially at very-high and ultra-high frequencies. Electrode contact surfaces should be kept clean and free of oxide coatings.

Cooling—Sufficient cooling air must be provided for the anode and body seals to maintain operating temperatures below the rated maximum value of 250°C.

The nominal plate dissipation rating is 10 watts and is dependent on convection cooling to a heat sink. Where adequate cooling is provided this value may be extended. Where greater plate dissipation is required use of the 3CPX100A5 is recommended.

It should be borne in mind that operating temperature is the sole criterion of cooling effectiveness, regardless of the coolant type, flow rate or coolant temperature. One method of measuring the surface temperatures is the use of temperature sensitive lacquer, such as "Tempilaq."

ELECTRICAL

Heater Operation—The rated heater voltage for the 3CPN10A5 is 6.0 volts. The heater voltage for the 3CPN10A5 should be maintained within plus or minus 5% of its intended value to minimize variations in circuit performance and to obtain maximum tube life.

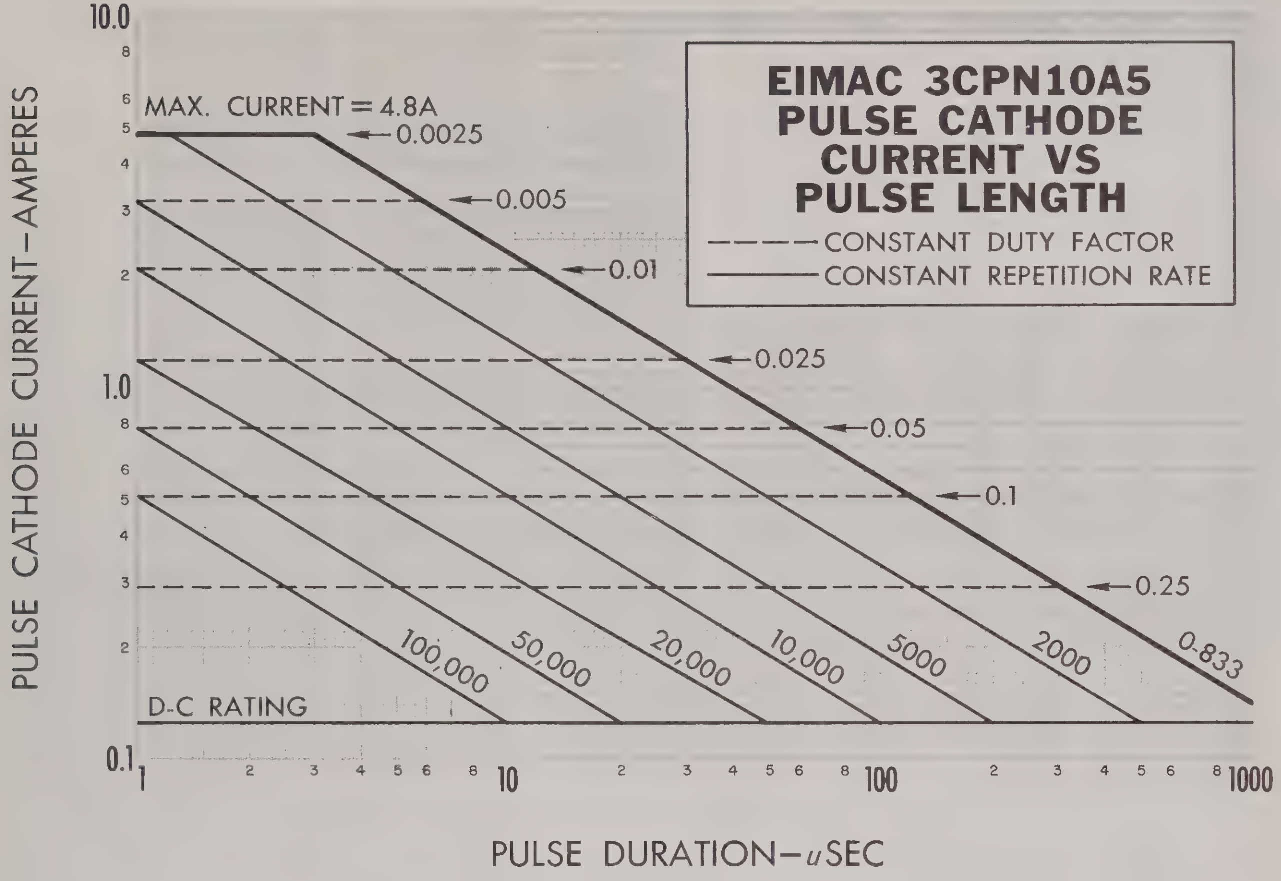
At frequencies above approximately 1000 megacycles, transit time effects begin to influence cathode temperature. The amount of driving power diverted to heating the cathode by back-bombardment will depend upon the frequency, the plate current, driving power, and duty factor. If the conditions of operation result in appreciable cathode back-heating, it may be necessary to start dynamic tube operation at normal heater voltage followed by a reduction of heater voltage to a lower value. The heater of the 3CPX10A5 must not be operated at less than 4.5 volts in any case.

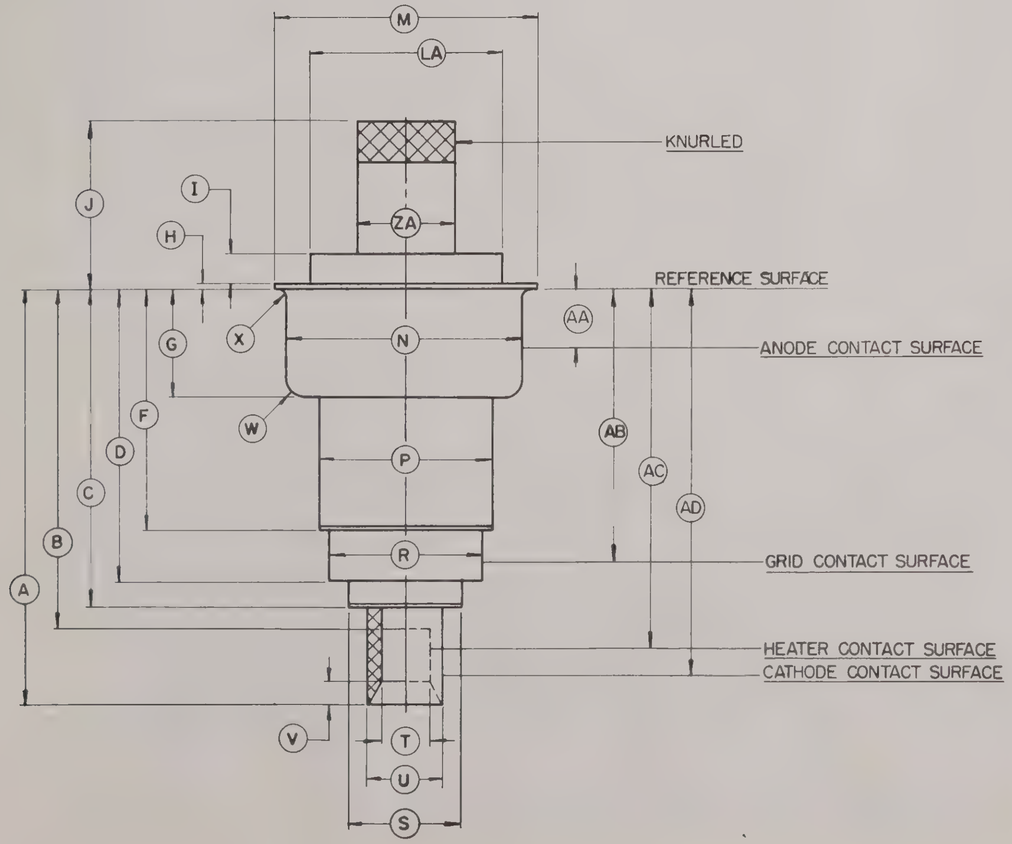
Cathode Operation—The oxide-coated unipotential cathode in this tube must be protected against excessively high emission currents. For all types of operation the maximum rated dc current is 125 milliamperes. In pulse service, current must be limited according to the curve on page 3.

It is recommended that the rated heater voltage be applied for a minimum of 60 seconds before other operating voltages are applied.

Control Grid Operation—Grid dissipation must not exceed the rated maximum 2.0 watts grid dissipation power. In pulse applications the instantaneous peak grid-to-cathode voltage must be limited to +250 to −750 volts.

Special Applications—If it is desired to operate this tube under conditions widely different from those given here, write to Power Grid Tube Marketing, Eitel-McCullough, Inc., 301 Industrial Way, San Carlos, California for information and recommendations.





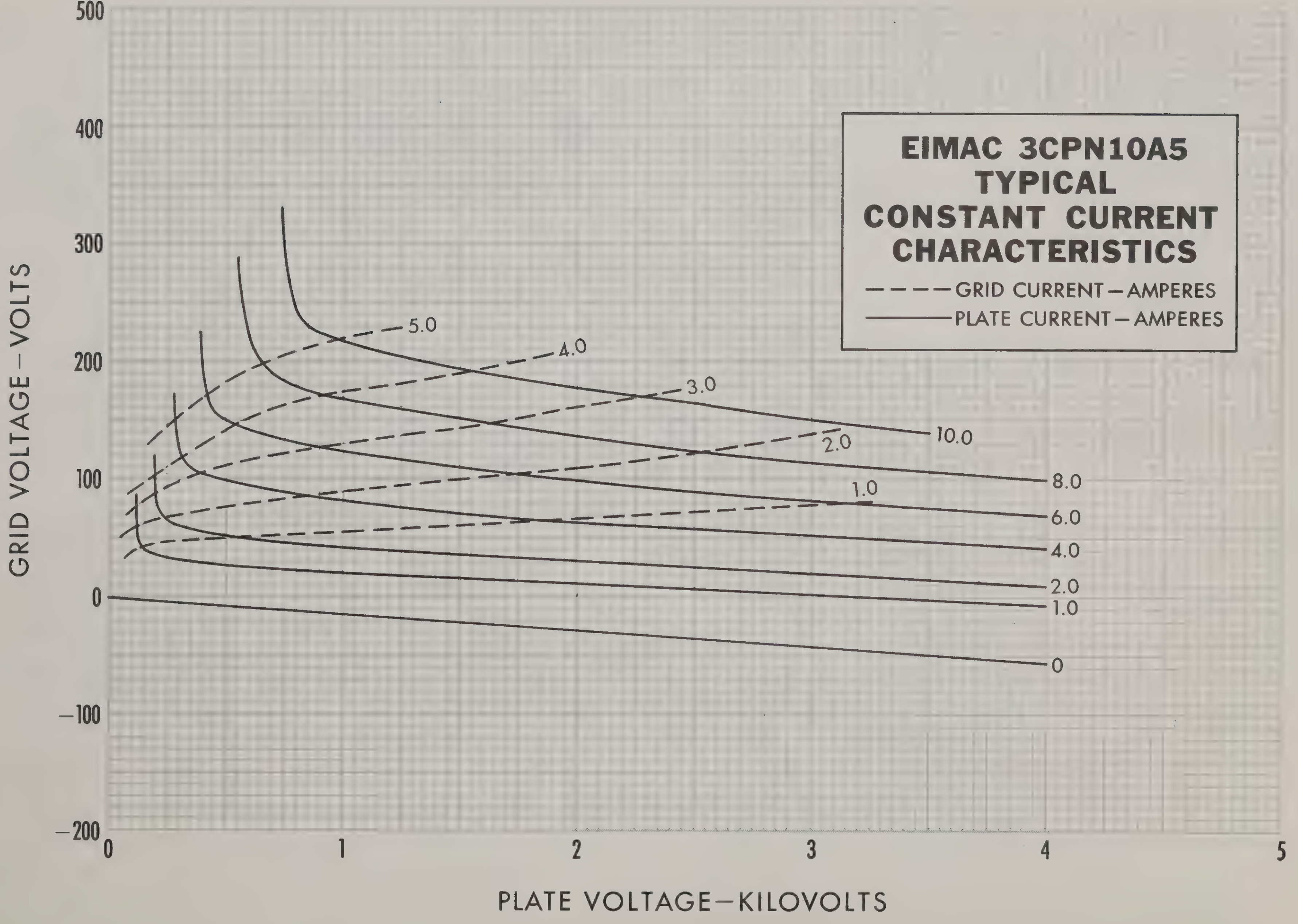
DIMENSIONS IN INCHES

DIMENSIONAL DATA

REF.	MIN.	MAX.	NOM.
A	1.815	1.875	
B		1.534	
C		1.475	
D	1.289	1.329	
F	.970	1.010	
G	.462	.477	
H		.040	
I		.185	
J	.766	.826	
M	1.180	1.195	
N	1.025	1.035	
P	.772	.792	
R	.655	.665	
S		.545	
T	.213	.223	
U	.315	.325	
V		.086	
W		.100	
X		.035	
LA			.850
ZA	.427	.447	

ELECTRODE CONTACT AREA

REF		
AA	.198 ± .163	ANODE
AB	1.225 ± .040	GRID
AC	1.631 ± .097	HEATER
AD	1.645 ± .170	CATHODE


EIMAC 3CPN10A5
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
GRID CURRENT—AMPERES
PLATE CURRENT—AMPERES
5.0
4.0
3.0
2.0
1.0
10.0
8.0
6.0
4.0
2.0
1.0
0
GRID VOLTAGE—VOLTS
500
400
300
200
100
0
−100
−200
0
1
2
3
4
5
PLATE VOLTAGE—KILOVOLTS

EITEL-McCULLOUGH, INC.
SAN CARLOS CALIFORNIA

7815R
3CPX100A5

UHF PULSE TRIODE

The Eimac 7815R/3CPX100A5 is a pulse rated version of the 3CX100A5. A longer grid-anode ceramic insulator is incorporated, making the tube useful at high altitude. The nominal plate dissipation rating is 100 watts.

The tube is usable in pulse applications to 3000 Megacycles. Electrical characteristics are similar to the 3CX100A5.

GENERAL CHARACTERISTICS

ELECTRICAL

	Min.	Nom.	Max.
Cathode: Oxide-coated, Unipotential			
Heating time	60		seconds
Heater:			
Voltage		6.0	volts
Current	0.90		1.05 amperes
Amplification Factor		100	
Transconductance (I b = 70 milliamperes)		25,000	Micromhos

Direct Interelectrode Capacitances	Min.	Max.
Grid-Cathode	5.7	7.0 uuf
Grid-Plate	1.85	2.10 uuf
Plate-Cathode		0.035 uuf
Frequency for Maximum Ratings		3000 Megacycles

MECHANICAL

Terminals	Graduated Cylindrical Surfaces
Maximum Operating Temperatures:	
Ceramic-to-Metal Seals	250°C
Anode Core	250°C
Operating Position	Any
Cooling	Forced Air
Maximum Overall Dimensions:	
Length	2.701 inches
Diameter	1.264 inches
Net Weight	2.5 ounces
Shipping Weight (approx.)	7.0 ounces

PLATE PULSED OSCILLATOR OR AMPLIFIER CLASS-C

MAXIMUM RATINGS

PEAK PULSE PLATE VOLTAGE	3500 MAX. VOLTS
DC GRID VOLTAGE	-150 MAX. VOLTS
PULSE PLATE CURRENT	3.0 MAX. VOLTS
DC CATHODE CURRENT	125 MAX. MA
PULSE GRID CURRENT	1.8 MAX. AMPS
PLATE DISSIPATION (AVG)	100 MAX. WATTS
GRID DISSIPATION (AVG)	2 MAX. WATTS

TYPICAL OPERATION

Pulse Plate Voltage	3500	3500 volts
Pulse Plate Current	3.0	3.0 amps
DC Plate Current (avg)	7.5	9 mA
DC Grid Current (avg)	4.5	3 mA
Pulse Power Output	1600	2000 watts
Frequency	3000	2500 Mc
Pulse Length	3	5 usec
Duty Factor	0.0025	0.003

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GRID PULSED OSCILLATOR OR AMPLIFIER CLASS-C

MAXIMUM RATINGS

DC PLATE VOLTAGE	2000 MAX. VOLTS
DC GRID VOLTAGE	-150 MAX. VOLTS
PULSE PLATE CURRENT	3.0 MAX. AMPS
DC CATHODE CURRENT	125 MAX. MA.
PLATE DISSIPATION (AVG)	100 MAX. WATTS
GRID DISSIPATION (AVG)	2 MAX. WATTS

TYPICAL OPERATION

DC Plate Voltage	1600	1700 volts
DC Grid Voltage	-45	-45 volts
Pulse Plate Current	3.0	1.9 amps
Pulse Grid Current	1.8	1.1 amps
Pulse Power Output	1000	1500 watts
Frequency	3000	1100 Mc
Pulse Length	3	3.5 usec
Duty Factor	0.0025	0.001

APPLICATION

MECHANICAL

Mounting—The 3CPX100A5 may be operated in any position. It should be firmly held in place by spring-finger collets bearing on the terminal surfaces. In use the tube should seat against the underside of the anode-terminal flange which is on the plane of reference for longitudinal dimensions. In appplications involving severe shock and vibration, the tube may be clamped in place by applying a suitable clamping device to the anode-terminal flange. It is recommended that no other portion of the tube be subjected to clamping forces.

Connections—The terminals are in the form of concentric cylinders of graduated diameters conveniently used with coaxial tuning devices. Spring-fingered collets should be used to make contact with the anode, grid, cathode and heater terminals. Adequate contact area and spring pressure should be provided to minimize heating and to prevent erratic circuit performance at the higher frequencies. Non-contacting or intermittently-contacting collet fingers will cause troublesome circuit behavior, especially at very-high and ultra-high frequencies. Electrode contact surfaces should be kept clean and free of oxide coatings.

Cooling—Sufficient cooling air must be provided for the anode and body seals to maintain operating temperatures below the rated maximum value of 250°C. At sea level, with 20°C air, approximately 12.5 CFM of cooling air directed across the anode through a suitale cowling will maintain safe anode temperature. In pulse applications requiring low plate dissipation and/or small size, the coolerless 3CPN10A5 should be considered.

The nominal plate dissipation rating is 10 watts and is dependent on convection cooling to a heat sink. Where adequate cooling is provided this value may be extended. Where greater plate dissipation is required use of the 3CPX100A5 is recommended.

It should be borne in mind that operating temperature is the sole criterion of cooling effectiveness, regardless of the coolant type, flow rate or coolant temperature. One method of measuring the surface temperatures is the use of temperature sensitive lacquer, such as "Tempilaq."

ELECTRICAL

Heater Operation—The rated heater voltage for the 3CPX100A5 is 6.0 volts. The heater voltage for the 3CPX100A5 should be maintained within plus or minus 5% of its intended value to minimize variations in circuit performance and to obtain maximum tube life.

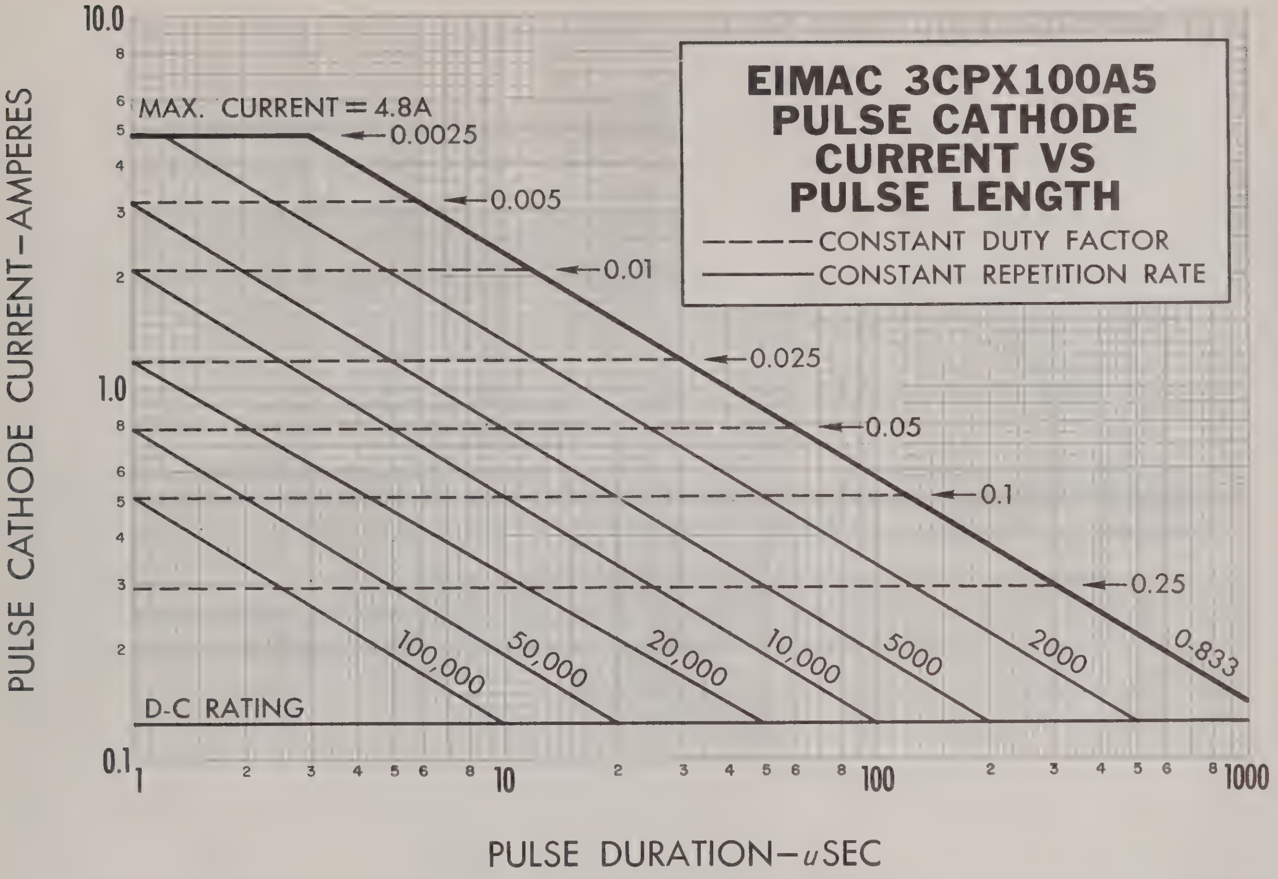
At frequencies above approximately 1000 megacycles, transit time effects begin to influence cathode temperature. The amount of driving power diverted to heating the cathode by back-bombardment will depend upon the frequency, the plate current, driving power, and duty factor. If the conditions of operation result in appreciable cathode back-heating, it may be necessary to start dynamic tube operation at normal heater voltage followed by a reduction of heater voltage to a lower value. The heater of the 3CPX100A5 must not be operated at less than 4.5 volts in any case.

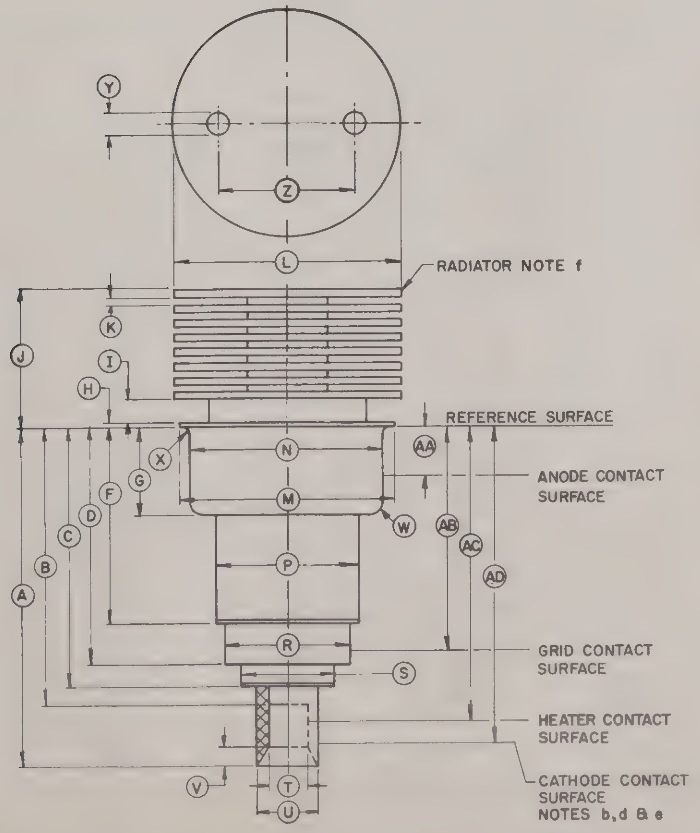
Cathode Operation—The oxide-coated unipotential cathode in this tube must be protected against excessively high emission currents. For all types of operation the maximum rated dc current is 125 milliamperes. In pulse service, current must be limited according to the curve on page 3.

It is recommended that the rated heater voltage be applied for a minimum of 60 seconds before other operating voltages are applied.

Control Grid Operation—Grid dissipation must not exceed the rated maximum 2.0 watts grid dissipation power. In pulse applications the instantaneous peak grid-to-cathode voltage must be limited to +250 to −750 volts.

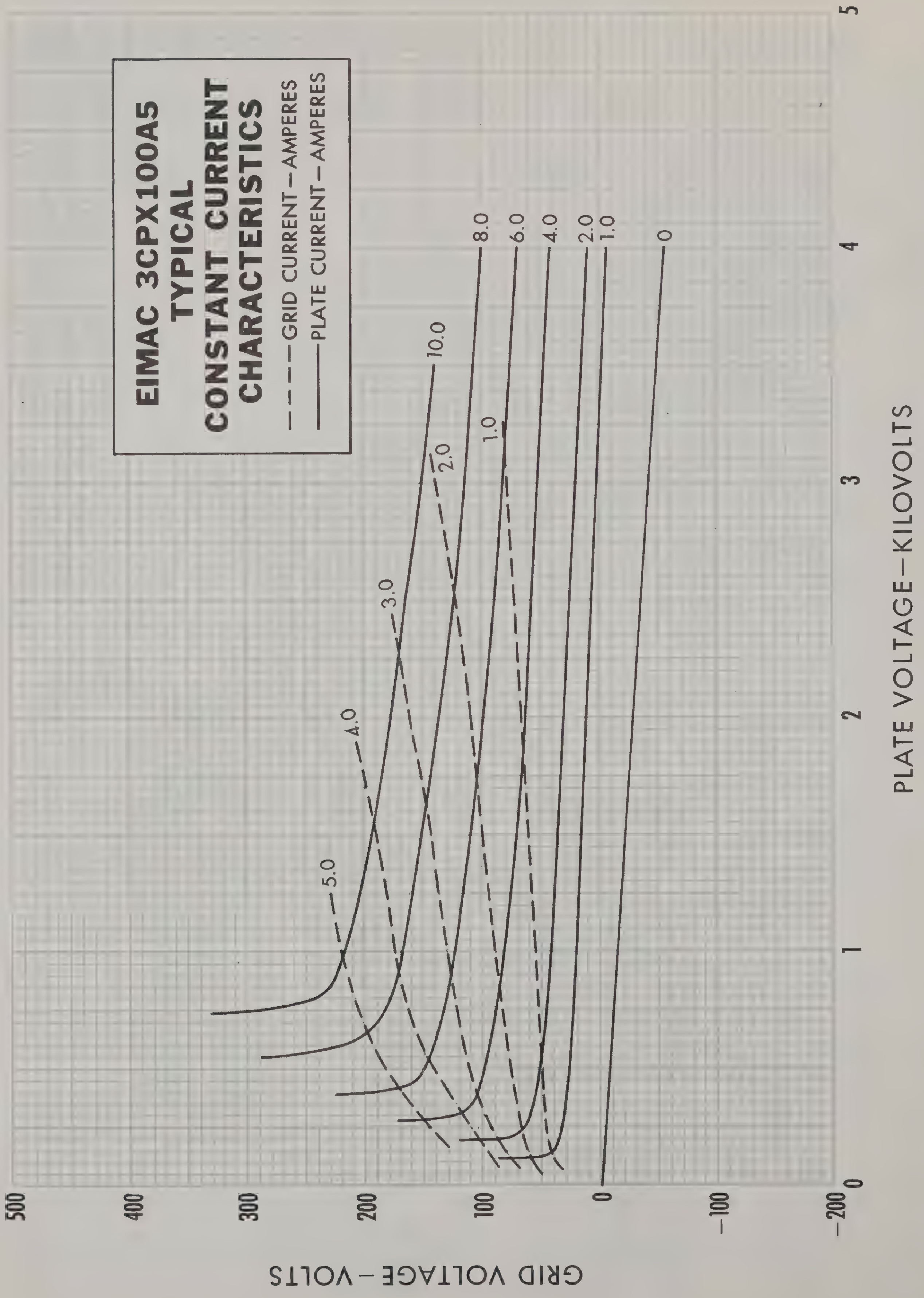
Special Applications—If it is desired to operate this tube under conditions widely different from those given here, write to Power Grid Tube Marketing, Eitel-McCullough, Inc., 301 Industrial Way, San Carlos, California for information and recommendations.





DIMENSIONS IN INCHES

DIMENSIONAL DATA			
REF.	MIN.	MAX.	NOM.
A	1.815	1.875	
B		1.534	
C		1.475	
D	1.289	1.329	
F	.970	1.010	
G	.462	.477	
H		.040	
I	.125	.185	
J	.766	.826	
K	.025	.046	
L	1.234	1.264	
M	1.180	1.195	
N	1.025	1.035	
P	.772	.792	
R	.655	.665	
S		.545	
T	.213	.223	
U	.315	.325	
V		.086	
W		.100	
X		.035	
Y	.105	.145	
Z	.650	.850	
AA	.035	.361	
AB	1.165	1.265	
AC	1.534	1.728	
AD	1.475	1.815	


EIMAC 3CPX100A5
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
— — — GRID CURRENT—AMPERES
——— PLATE CURRENT—AMPERES
10.0
8.0
6.0
4.0
2.0
1.0
0
5.0
4.0
3.0
2.0
1.0
PLATE VOLTAGE—KILOVOLTS
0
1
2
3
4
5
GRID VOLTAGE—VOLTS
500
400
300
200
100
0
−100
−200

TECHNICAL DATA

3CV1500A7

HIGH-MU POWER TRIODE

The 3CV1500A7 is an integral-boiler, ceramic/metal, vapor cooled zero-bias triode, intended for Class AB2 linear amplifier service in either grid driven or cathode driven configuration. Except for the anode dissipation rating, the 3CV1500A7 is electrically identical to the EIMAC 8283/3CX-1000A7.

The 3CV1500A7 is especially recommended when the ambient noise level must be reduced to a minimum, since high-pressure/high-volume forced-air cooling is not required.

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Filament: Thoriated-tungsten Mesh	
Voltage	5.0 ± 0.25 V
Current, at 5.0 volts	30 A
Amplification Factor (average)	200
Direct Interelectrode Capacitances (grounded filament) [2]	
Cin	32.0 pF
Cout	0.15 pF
Cgp	14.0 pF
Direct Interelectrode Capacitances (grounded grid) [2]	
Cin	32.0 pF
Cout	14.0 pF
Cpk	0.15 pF
Frequency of Maximum Rating:	
CW	220 MHz

1. Characteristics and operating values are based upon performance tests. These figures may change without notice as a result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.

2. Capacitance values are for a cold tube, as measured in a shielded fixture in accordance with Electronic Industries Association Standard RS-191.

MECHANICAL

Maximum Overall Dimensions:	
Length	5.110 in; 129.8 mm
Diameter	3.355 in; 85.2 mm
Net Weight	2.38 lb; 1.08 kg
Operating Position	Vertical, base down
Maximum Operating Temperature:	
Ceramic/metal seals	250°C
Cooling	Vapor and Forced Air
Base	Special Breechlock
Recommended Socket	EIMAC SK-861

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RADIO FREQUENCY LINEAR AMPLIFIER CATHODE DRIVEN Class AB_2

MAXIMUM RATINGS:

DC PLATE VOLTAGE	3500	VOLTS
DC PLATE CURRENT	1.0	AMPERE
PLATE DISSIPATION	1500	WATTS
GRID DISSIPATION	45	WATTS

1. Adjust to specified zero-signal dc plate current.
2. The intermodulation distortion products are referenced against one tone of a two equal tone signal.
3. Approximate values.

TYPICAL OPERATION (Frequencies to 30 MHz)
Class AB2 Peak Envelope or Modulation Crest Conditions

Plate Voltage	2000	2500	3500	Vdc
Grid Voltage[1]	0	0	-12	Vdc
Zero-Signal Plate Current	238	305	129	mAdc
Single Tone Plate Current	875	800	857	mAdc
Two-Tone Plate Current	600	585	590	mAdc
Single-Tone Grid Current[3]	230	205	225	mAdc
Two-Tone Grid Current[3]	130	120	120	mAdc
Peak rf Drive Voltage[3]	80	74	110	v
Peak Driving Power	80	60	100	w
Plate Dissipation	800	830	940	W
Useful Output Power	940	1170	2060	W
Resonant Load Impedance	1100	1670	2300	Ω
Intermodulation Distortion Products[2]				
3rd Order	-29	-31	-31	db
5th Order	-37	-40	-39	db

AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR Class AB_2, Grid Driven(Sinusoidal Wave)

MAXIMUM RATINGS (Per Tube)

DC PLATE VOLTAGE[1]	3500	VOLTS
DC PLATE CURRENT	1.0	AMPERE
PLATE DISSIPATION	1500	WATTS
GRID DISSIPATION	45	WATTS

1. See zero-bias operation in Application Section.
2. Approximate value.
3. Per Tube.
4. Nominal drive power is one-half peak power.

TYPICAL OPERATION (Two Tubes)

Plate Voltage	2000	2500	Vdc
Grid Voltage	0	0	Vdc
Zero-Signal Plate Current	400	500	mAdc
Max. Signal Plate Current	2.0	2.0	Adc
Max. Signal Grid Current[2]	590	480	mAdc
Peak af Grid Voltage[3]	95	90	v
Peak Driving Power[4]	25	44	w
Plate Input Power	4000	5000	W
Max. Signal Plate Dissipation	1650	1900	W
Plate Output Power	2350	3100	W
Load Resistance (plate to plate)	1900	2580	Ω

NOTE: TYPICAL OPERATION data are obtained by measurement or calculation from published characteristic curves. Adjustment of the rf grid voltage to obtain the specified plate current at the specified bias, and plate voltages is assumed. If this procedure is followed, there will be little variation in output power when the tube is changed, even though there may be some variation in grid current. The grid current which results when the desired plate current is obtained is incidental and varies from tube to tube. These current variations cause no difficulty so long as the circuit maintains the correct voltage in the presence of the variations in current. If grid bias is obtained principally by means of a grid resistor, the resistor must be adjustable to obtain the required bias voltage when the correct rf grid voltage is applied.

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.	
Heater: Current at 5.0 volts	28.0	33.0	A
Cathode Warmup Time	5	---	sec.
Interelectrode Capacitance[1] (grounded grid connection)			
Cin	29.0	35.0	pF
Cout	12.0	16.0	pF
Cpk	---	0.2	pF

1. Capacitance values are for a cold tube as measured in a special shielded fixture in accordance with Electronic Industries Association Standard RS-191.

APPLICATION

MECHANICAL

MOUNTING - The 3CV1500A7 must be mounted with its axis vertical, base down, with sufficient clearance for an insulated makeup water line to connect to the side of the integral anode boiler and an outlet steam line to attach to the top of the boiler. The use of the EIMAC socket SK-861 is recommended.

COOLING - Cooling is accomplished by the presence of distilled water at a controlled level in the integral anode boiler. The energy dissipated by the anode causes the water to boil at the anode surface, to be converted into steam and carried away to a condenser. This boiling action keeps the anode surface at approximately 100°C.

The water in the boiler must be maintained at the correct level, as shown on the outline drawing for the tube. This is normally accomplished with a special control unit, mounted with the correct relationship to the tube so as to maintain the water level in the tube boiler at the specified level. A condenser unit is used to convert the steam back to water, which is then returned to reservoir/control-box/boiler system.

Forced-air cooling of the tube base is required, with 15 cfm minimum directed across and through the socket and base of the tube. Air flow should be applied simultaneously with the application of electrode voltages, including the filament, and may be removed simultaneously with the removal of filament voltage.

ELECTRICAL

FILAMENT - Rated filament voltage for the 3CV1500A7 is 5.0 volts. Filament voltage, as measured at the socket, should be maintained at this value to obtain optimum performance and maximum tube life. In no case should it be allowed to deviate from 5.0 volts by more than plus or minus five per cent.

INPUT CIRCUIT - When the 3CV1500A7 is operated as grounded-grid rf amplifier, the use of a resonant tank in the cathode circuit is recommended to obtain greatest linearity and power output. For best results with a single-ended amplifier, it is suggested that the cathode tank circuit operate at a "Q" of five or more.

CLASS-C OPERATION - Although designed for Class-AB2 service, the 3CV1500A7 may be operated as a Class-C power amplifier or oscillator, or as a plate-modulated rf amplifier. The zero-bias characteristic can be used to advantage in Class-C amplifiers by employing only grid leak bias. If driving power fails, plate dissipation is kept to a low level since the tube will operate at normal, static zero-bias conditions.

ZERO-BIAS OPERATION - Operating at zero-bias is not recommended with plate voltages over 2500 volts since plate dissipation may be exceeded. Similarly, the safety of zero-bias operation as mentioned above under "Class-C Operation" is not available at plate voltages above 2500 volts. Straight Class-C or Class-AB2 operation is, of course, permissible up to 3500 volts where other ratings are not exceeded. Higher plate voltage may be used with the proper bias.

PLATE DISSIPATION - The plate dissipation of 1500 watts attainable through vapor cooling provides a large margin of safety in most applications. The rating may be exceeded during tuning for brief periods.

Since the tube anode is usually at high potential to ground, water and steam connections to the anode are made through insulating tubing. These insulating sections should be long enough so that column resistance is above 100,000 ohms per 1000 supply volts. It is essential that high purity water be used to minimize power loss and corrosion of metal fittings. Good distilled or deionized water will have a resistance of 1 to 2 megohms per cm3. Water should be discarded if resistivity falls to 50,000 ohms cm3.

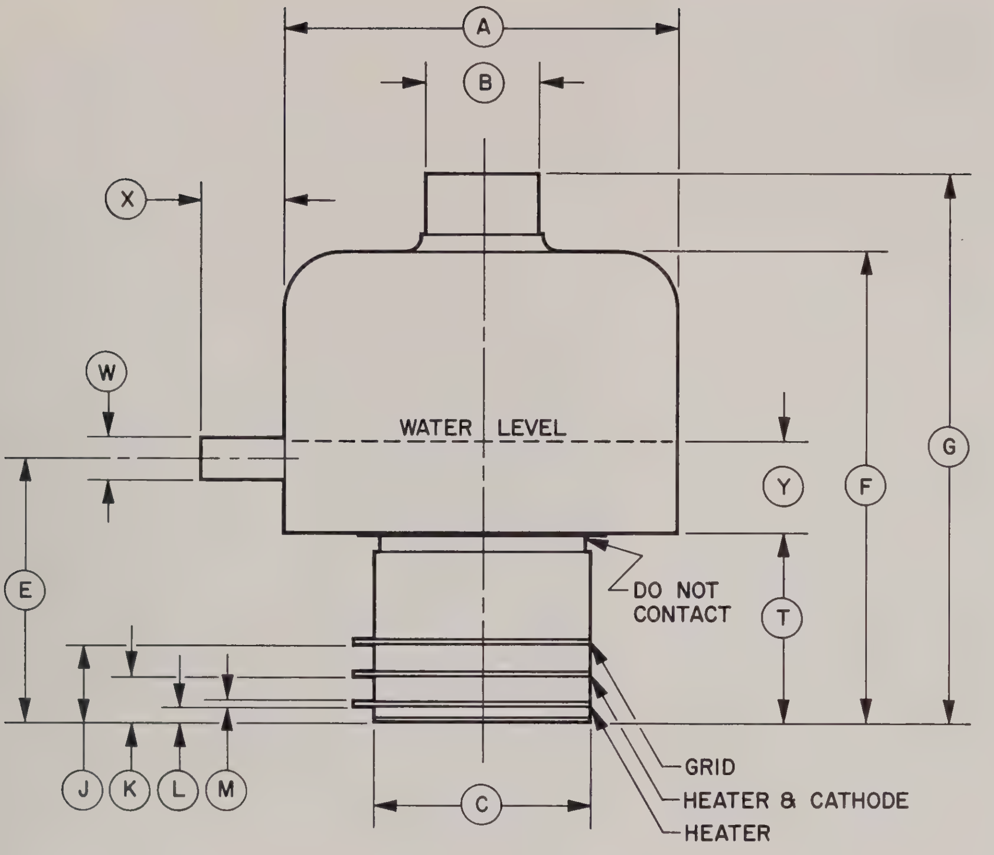
HIGH VOLTAGE - Normal operating voltages used with the 3CV1500A7 are deadly, and the equipment must be designed properly and operating precautions must be followed. Design all equipment so that no one can come in contact with high voltages. All equipment must include safety enclosures for high-voltage circuits and terminals, with interlock switches to open primary circuits of the power supply and to discharge high-voltage condensers whenever access doors are opened. Interlock switches must not be bypassed or "cheated" to allow operation with access doors open. Always remember that HIGH VOLTAGE CAN KILL.

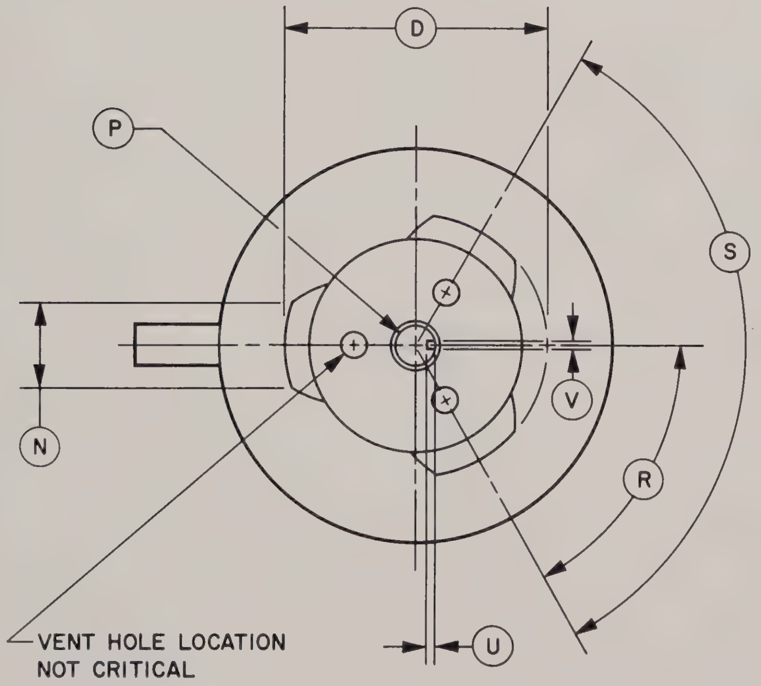
RADIO FREQUENCY RADIATION - Avoid exposure to strong rf fields even at relatively low frequency. Absorption of rf energy by human tissue is dependent on frequency. Under 30 MHz, most of the energy will pass completely through the human body with little attenuation or heating effect. Public health agencies are concerned with the hazard, however, even at these frequencies, and it is worth noting that some commercial dielectric heating units actually operate at frequencies as low as the 13 and 27 MHz bands.

INTERELECTRODE CAPACITANCE - The actual internal interelectrode capacitance of a tube is influenced by many variables in most applications, such as stray capacitance to the chassis, capacitance added by the socket used, stray capacitance between tube terminals, and wiring effects. To control the actual capacitance values within the tube, as the key component involved, the industry and the Military Services use a standard test procedure as described in Electronic Industries Association Standard RS-191. This requires the use of specially constructed test fixtures which effectively shield all external tube leads from each other and eliminates any capacitance reading to ''ground''. The test is performed on a cold tube. Other factors being equal, controlling internal tube capacitance in this way normally assures good interchangeability of tubes over a period of time, even when the tube may be made by different manufacturers. The capacitance values shown in the manufacturer's technical data, or test specifications, normally are taken in accordance with Standard RS-191.

The equipment designer is therefore cautioned to make allowance for the actual capacitance values which will exist in any normal application. Measurements should be taken with the socket and mounting which represent approximate final layout if capacitance values are highly significant in the design.

SPECIAL APPLICATION - If it is desired to operate this tube under conditions widely different from those listed here, write to Power Grid Tube Division, EIMAC Division of Varian, 301 Industrial Way, San Carlos, California 94070, for information and recommendations.

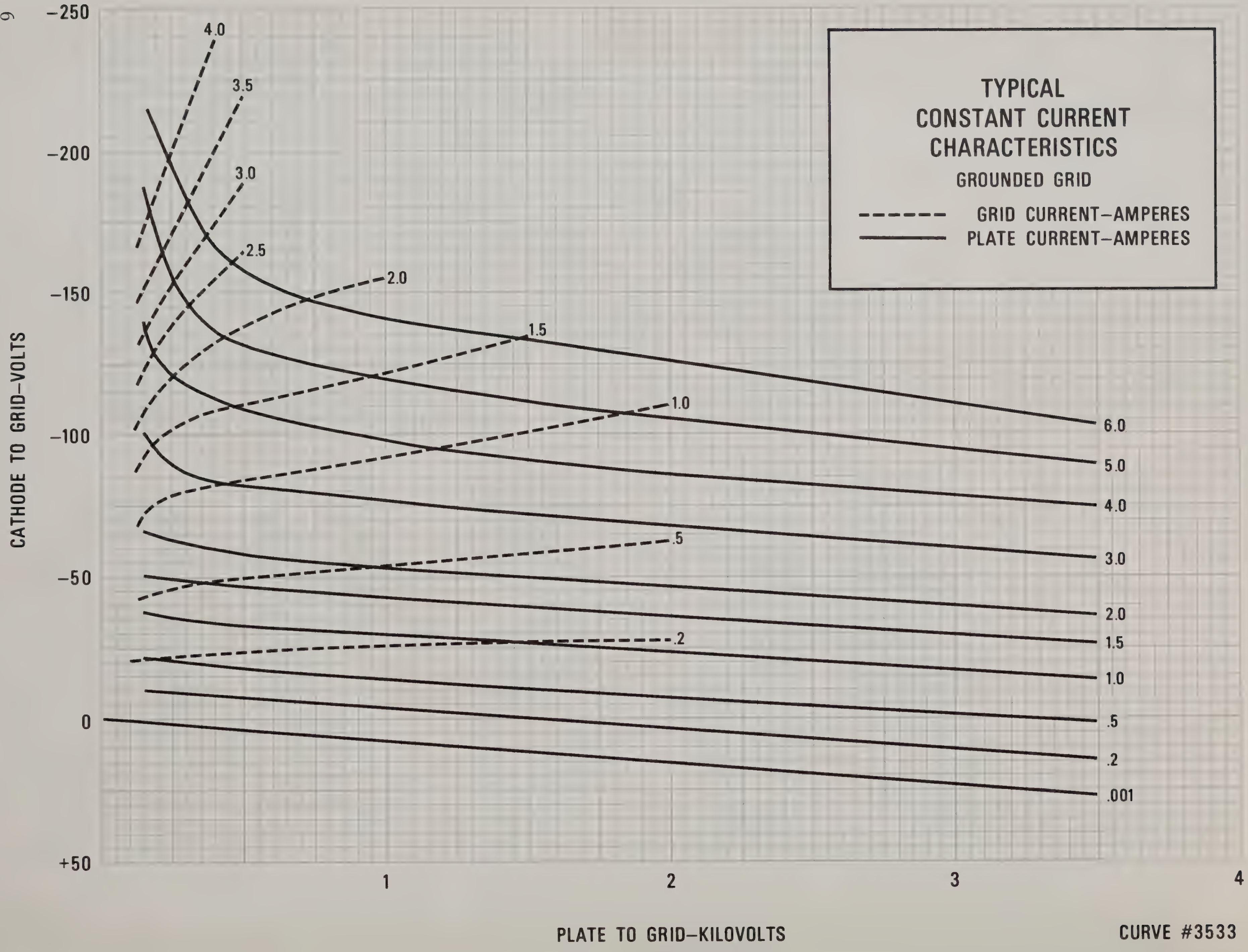




DIMENSIONAL DATA						
DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	- -	- -	3.355	- -	- -	85.22
B	- -	- -	1.000	- -	- -	25.40
C	1.870	1.900	- -	47.50	48.26	- -
D	2.250	2.300	- -	57.15	58.42	- -
E	- -	- -	2.400	- -	- -	60.96
F	4.190	4.315	- -	106.43	109.60	- -
G	4.850	5.110	- -	123.19	129.79	- -
J	0.690	0.710	- -	17.53	18.03	- -
K	0.415	0.435	- -	10.54	11.05	- -
L	0.140	0.165	- -	3.57	4.19	- -
M	0.020	0.030	- -	0.50	0.76	- -
N	0.700	0.800	- -	17.78	20.32	- -
P	0.314	0.316	- -	7.98	8.03	- -
R	55°	65°	- -	55°	65°	- -
S	115°	125°	- -	115°	125°	- -
T	- -	- -	1.720	- -	- -	43.69
U	0.025	0.048	- -	0.64	1.22	- -
V	0.045	0.070	- -	1.14	1.78	- -
W	- -	- -	0.375	- -	- -	9.53
X	- -	- -	0.750	- -	- -	19.05
Y	0.500	1.000	- -	- -	- -	- -

NOTES:

1. REF. DIMENSIONS ARE FOR INFO. ONLY & ARE NOT REQUIRED FOR INSPECTION PURPOSES.


TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
GROUNDED GRID
GRID CURRENT–AMPERES
PLATE CURRENT–AMPERES
4.0
3.5
3.0
2.5
2.0
1.5
1.0
.5
.2
6.0
5.0
4.0
3.0
2.0
1.5
1.0
.5
.2
.001
–250
–200
–150
–100
–50
0
+50
CATHODE TO GRID–VOLTS
1
2
3
4
PLATE TO GRID–KILOVOLTS

CURVE #3533

EITEL-McCULLOUGH, INC.

TENTATIVE DATA

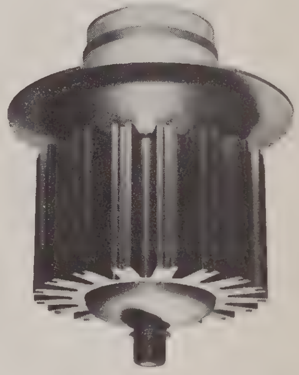
3CV30,000A3

MEDIUM-MU
VAPOR-COOLED
POWER TRIODE

The Eimac 3CV30,000A3 is a vapor-cooled, ceramic-metal power triode designed primarily for use in industrial radio-frequency heating service. Its vapor-cooled anode is conservatively rated at 30 kilowatts of plate dissipation when mounted in an Eimac BR-200 boiler.

Full input of 60 kilowatts is permissible up to 100 megacycles. Large reserve emission is available from its one kilowatt filament and the grid structure is rated at one ampere making this tube an excellent choice for severe applications.

It is also recommended as a grounded grid FM amplifier, a conventional plate-modulated amplifier or as a linear amplifier in new equipment designs.



GENERAL CHARACTERISTICS

ELECTRICAL	Min.	Nom.	Max	
Filament: Thoriated-Tungsten				
Voltage		6.3		volts
Current	152		172	amperes
Amplification Factor		20		
Interelectrode Capacitances, Grounded Cathode:				
Grid-Filament	48		58	μμf
Plate-Filament	1.2		1.5	μμf
Grid-Plate	30		38	μμf
Frequency for Maximum Ratings				100 Mc

MECHANICAL	
Base	Coaxial
Recommended Socket	Eimac SK-1310
Recommended Boiler	Eimac BR-200
Operating Position	Vertical, base up
Cooling	Vapor & Forced air
Maximum Operating Temperatures:	
Anode Flange	200°C
Ceramic-to-Metal Seals	250°C
Maximum Dimensions:	
Height	8.75 inches
Diameter	7.5 inches
Net Weight	18 pounds

RF INDUSTRIAL OSCILLATOR

Class-C (Filtered DC Power Supply)

MAXIMUM RATINGS	
DC PLATE VOLTAGE	10,000 VOLTS
DC PLATE CURRENT	6.0 AMPS
DC GRID CURRENT	1.0 AMP
PLATE INPUT POWER	60 KW
PLATE DISSIPATION	30 KW

TYPICAL OPERATION		
DC Plate Voltage	7000	10,000 volts
DC Plate Current	6.0	6.0 amps
DC Grid Voltage	–600	–800 volts
DC Grid Current	.66	.315 amps
Peak Positive Grid Voltage	440	360 volts
Driving Power	660	365 watts
Plate Input Power	42	60 kW
Plate Dissipation	12	18 kW
Plate Output Power	30	42 kW
Approximate Load Impedance	600	750 ohms

(Effective 10-1-63) Copyright 1963 by Eitel-McCullough, Inc.

RADIO-FREQUENCY POWER AMPLIFIER PLATE-MODULATED

Class-C

MAXIMUM RATINGS		
DC PLATE VOLTAGE	7000 MAX.	VOLTS
DC PLATE CURRENT	5.0 MAX.	AMPS
PLATE DISSIPATION	20 MAX.	KW
GRID DISSIPATION	500 MAX.	WATTS

TYPICAL OPERATION			
DC Plate Voltage	5000	7000	volts
DC Grid Voltage	–600	–820	volts
DC Plate Current	5.0	5.0	amps
DC Grid Current	600	600	mA
Driving Power	600	750	watts
Plate Output Power	17.8	27.5	kW

RADIO-FREQUENCY LINEAR AMPLIFIER Class-AB$_2$

MAXIMUM RATINGS		
DC PLATE VOLTAGE	10000 MAX.	VOLTS
DC PLATE CURRENT	6.0 MAX.	AMPS
PLATE DISSIPATION	30 MAX.	KW
GRID DISSIPATION	500 MAX.	WATTS

*Adjust to give specified zero-signal dc plate current

TYPICAL OPERATION			
DC Plate Voltage	7000	10000	volts
DC Grid Voltage*	–250	–400	volts
Zero-Sig Plate Current	2.0	2.0	amps
Max-Sig DC Plate Current	6.0	6.0	amps
Max-Sig DC Grid Current	375	333	mA
Peak RF Grid Voltage	530	700	volts
Driving Power	200	240	watts
Plate Output Power	26.4	41	kW

Note: "TYPICAL OPERATION" data are obtained by calculation from published characteristic curves. No allowance for circuit losses has been made.

APPLICATION

ELECTRICAL

Filament — The rated filament voltage for the 3CV30,000A3 is 6.3 volts. Filament voltage, as measured at the socket, must be maintained at 6.3 volts plus or minus five percent for maximum tube life and consistent performance.

Control Grid Operation — The grid current rating is one ampere dc. This value should not be exceeded for more than very short periods such as during tuning and over-current protection in the grid circuit should be provided. Ordinarily it will not be necessary to operate with more than 0.4 to 0.6 amperes grid current to obtain reasonable efficiency. In industrial heating service with varying loads, grid current should be monitored continuously with a dc current meter. The maximum grid dissipation rating is 500 watts.

Plate Operation — The maximum plate input power rating is 60 kilowatts at 10,000 volts and 6.0 amperes dc. This rating applies for Class C amplifier or oscillator service and for Class AB applications. When used as a plate modulated rf amplifier, input is reduced to 7000 volts at 5.0 amperes dc. Maximum input may be exceeded for short periods during tuning without exceeding plate dissipation ratings.

Plate over-current protection should be provided to remove plate voltage quickly in the event of an overload or an arc-over at the load. In addition current limiting power supply resistors should be used. These precautions are especially important in industrial service with its wide variations in loading.

Spark gaps from plate to ground should be used to prevent transient voltages from flashing across the tube envelope during any fault conditions.

Special Application — If it is desired to operate this tube under conditions widely different from these given here, write to Power Grid Tube Marketing Department, Eitel-McCullough, Inc., 301 Industrial Way, San Carlos, California, for information and recommendations.

MECHANICAL

Mounting — The 3CV30,000A3 must be mounted vertically, base up in an Eimac BR-200 boiler. It is very important that the boiler tube assembly be mounted vertically, the water be maintained at the suggested level, and that the flange of the tube makes a vapor-tight seal against the rubber "O" ring and boiler.

Sockets — The Eimac SK-1310 socket is available for use with the 3CV30,000A3. Filament and grid connection are made to this socket.

Cooling — Cooling is accomplished by immersion of the anode in a distilled water-filled BR-200 boiler. The energy dissipated at the anode causes the water to boil and be converted into steam. Steam is carried away by convection to the condenser where it is cooled and condenses into water. Condensate is then returned to the boiler.

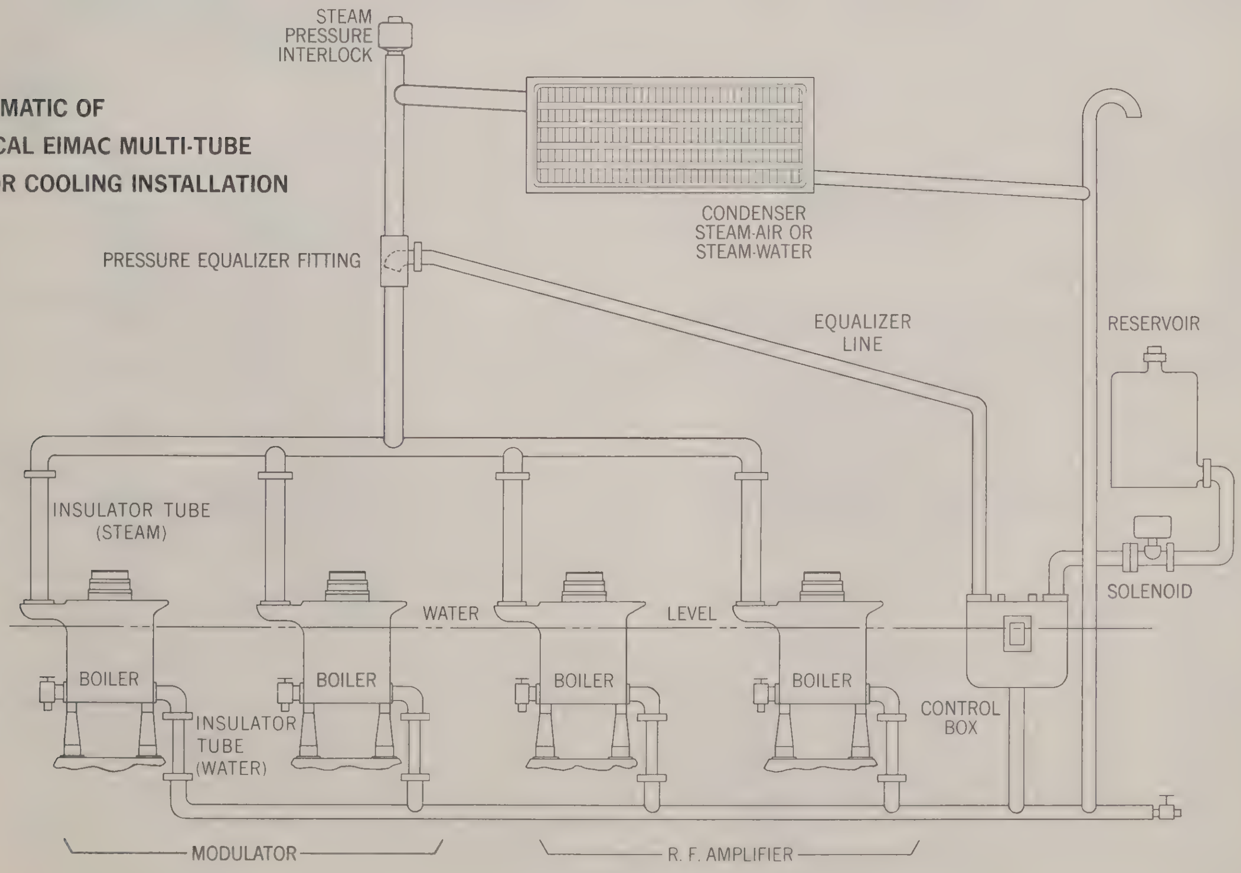
The boiling action maintains the anode surface temperature at approximately 100°C. In a properly designed system (such as the 3CV30,000A3 and BR-200) it is unlikely that anode surface temperature will ever exceed 125°C—well below the rated maximum for the tube—even at full plate dissipation levels.

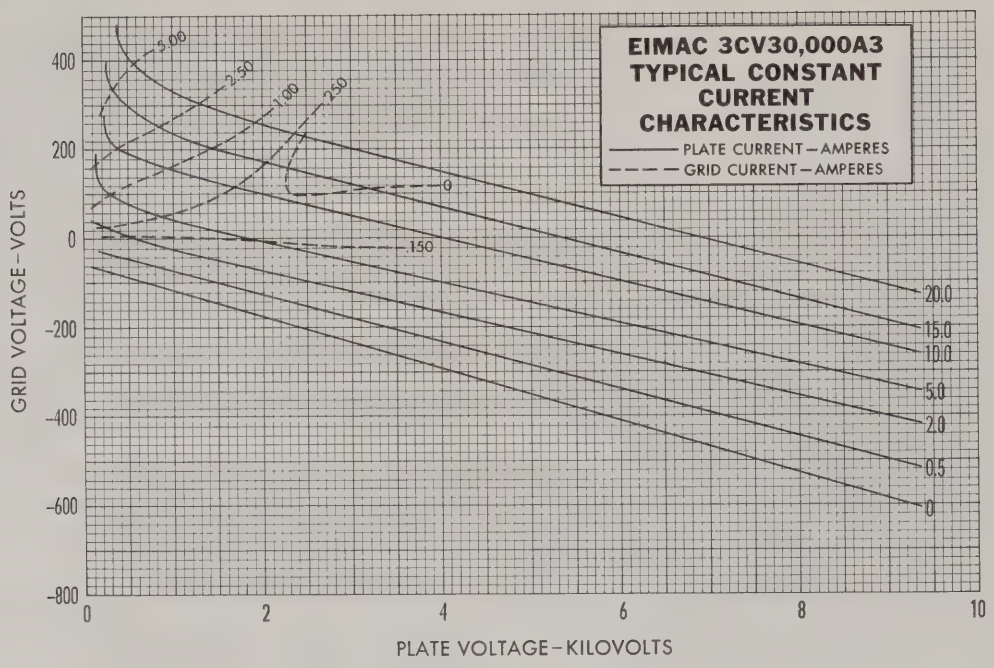
The water in the boiler must be maintained at a constant level, just below the top of the anode fins. This level is marked on the boiler. A recommended system for assuring constant water level is shown in the system diagram below. This system incorporates an Eimac CB-202 Control Box to sense water level and a small reservoir to supply make-up water on demand. In the event of a drop in system water level, a switch is closed in the control box, energizing a solenoid water valve in the line from the reservoir. When the make-up water brings the system back to the proper level, the switch is opened, de-energizing the solenoid valve. A second switch in the CB-202 Control Box senses a lower, danger level and can be used to actuate an alarm or shut down the system.

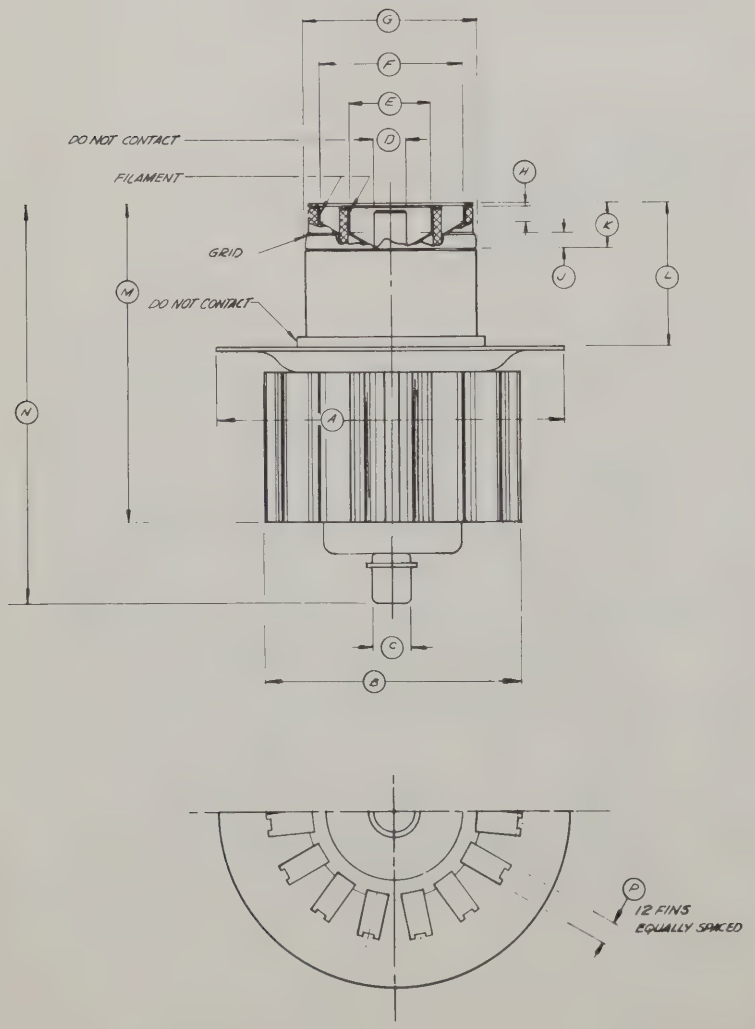
For reliable operation, it is essential that the Control Box be mounted so that the level sensed is the actual level in the boiler.

Separate cooling of the tube base is required and is accomplished by directing 30-50 CFM of cooling air into the base structure from the top of the socket.

SCHEMATIC OF TYPICAL EIMAC MULTI-TUBE VAPOR COOLING INSTALLATION







DIMENSIONS IN INCHES

DIMENSIONAL DATA			
REF.	**MIN.**	**MAX.**	**NOM.**
A			7.750
B			5.812
C	.855	.895	
D	.720	.760	
E	1.896	1.936	
F	3.133	3.173	
G	3.792	3.832	
H	.188		
J	.188		
K	.986	1.050	
L			3.062
M	6.920	6.990	
N	8.250	8.750	
P			.510

EIMAC
Division of Varian
SAN CARLOS
CALIFORNIA

3CW20,000A1

WATER-COOLED LOW-MU POWER TRIODE

The EIMAC 3CW20,000A1 is a ceramic and metal power triode intended primarily for use as an audio amplifier or modulator. This tube is also recommended for voltage-regulator applications where high current capability and low tube drop are important. Up to 20 kilowatts of plate power can be dissipated on its water-cooled anode. Except for plate dissipation, the tube is electrically identical to the 8158/3CX10,000A1.

GENERAL CHARACTERISTICS

ELECTRICAL

	Min.	Nom.	Max.	
Filament: Thoriated-Tungsten				
Voltage		7.5		volts
Current	94		104	amps
Amplification Factor	5.5		7.0	
Interelectrode Capacitances:				
Input	45.0		57.0	
Output	3.4		4.2	
Feedback	25.0		32.0	
Transconductance (Ib = 2.0 amps, Eb = 3000 volts)		20,000		umhos
Frequency for Maximum Ratings			140	MHz

MECHANICAL

Base	Coaxial	
Recommended Socket	EIMAC SK-300	
Operating Position	Vertical, base up or down	
Cooling	Water and Forced Air	
Maximum Operating Temperatures:		
Anode Core	250°C	
Ceramic-to-Metal Seals	250°C	
Maximum Dimensions:		
Height	11.4	inches
Diameter	4.7	inches
Net Weight	12	pounds

AUDIO-FREQUENCY AMPLIFIER OR MODULATOR

Class-AB_1

MAXIMUM RATINGS (Per Tube)

DC Plate Voltage	7000	volts
DC Plate Current	5.0	amps
Plate Dissipation	20	kW
Grid Dissipation	100	watts

*Adjust for zero-signal plate current

**At maximum signal without negative feedback

Effective grid circuit resistance must not exceed 200,000 ohms

TYPICAL OPERATION, Two Tubes

Sinusoidal Wave

DC Plate Voltage	7000	7000	volts
DC Grid Voltage*	–1300	–1300	volts
Zero-Sig DC Plate Current	1.5	1.5	amps
Max-Sig DC Plate Current	5.8	7.0	amps
Load Resistance, Plate-to-Plate	2460	1720	ohms
Peak AF Grid Driving Voltage (Per Tube)	1300	1300	volts
Max-Sig Driving Power	0	0	watts
Max-Sig Plate Output Power	24,400	29,100	watts
Total Harmonic Distortion**	2.9	3.6	per ct.

(Revised 6-1-67) © 1963, 1967 by Varian

Printed in U.S.A.

AUDIO-FREQUENCY AMPLIFIER OR MODULATOR

Class-A

MAXIMUM RATINGS

DC Plate Voltage	7000	volts
DC Plate Current	See Class-A derating table on Page 3	
Plate Dissipation	20	kW
Grid Dissipation	100	watts

*Adjust to give listed zero-signal DC plate current

**At maximum signal without negative feedback

TYPICAL OPERATION

DC Plate Voltage	2500	volts
DC Grid Voltage*	–290	volts
DC Plate Current	4.0	amps
Peak AF Grid Driving Voltage	290	volts
Load Resistance	2120	ohms
Max. Signal Plate Output Power	1800	watts
Second Harmonic Distortion**	6.75	per ct.

RADIO-FREQUENCY INDUSTRIAL OSCILLATOR

Class-C

MAXIMUM RATINGS

DC Plate Voltage	5000	volts
DC Plate Current	4.0	amps
Plate Dissipation	20	kW
Grid Dissipation	100	watts

TYPICAL OPERATION

DC Plate Voltage	5000	volts
DC Grid Voltage	–1500	volts
DC Plate Current	2.75	amps
DC Grid Current	200	mA
Driving Power	385	watts
Plate Output Power	11,000	watts

VOLTAGE REGULATOR SERVICE

Class-A

MAXIMUM RATINGS

DC Plate Voltage	10,000	volts
DC Plate Current	See Class-A derating table on Page 3	
Plate Dissipation	12	kW
Grid Dissipation	100	watts

TYPICAL OPERATION

DC Plate Voltage (tube drop)	5000	volts
DC Plate Current	0-2.0	amps

(These values are chosen according to Class-A derating table on Page 3)

Note: "TYPICAL OPERATION" data are obtained by calculation from published characteristic curves. No allowance for circuit losses, either input or output, has been made.

MINIMUM WATER-FLOW REQUIREMENTS

Plate Dissipation (watts)*	Quantity (GPM)	Pressure Drop (psi)
10,000	6.3	4.9
15,000	9.0	9.2
20,000	12.0	15.0

*Since the power dissipated by the filament is about 750 watts and since grid dissipation can, under some circumstances, represent another 100 watts, allowance has been made in preparing this tabulation for an additional 850 watts dissipation. Separate base cooling is required. This tabulation presumes that outlet-water temperature will be below 70°C and that inlet water temperature will not exceed 60°C. Under no conditions should these temperatures be exceeded, nor should system water pressure exceed 50 pounds per square inch.

APPLICATION

Voltage-Regulator Service—Maximum dc plate current and voltage are restricted according to the following table.

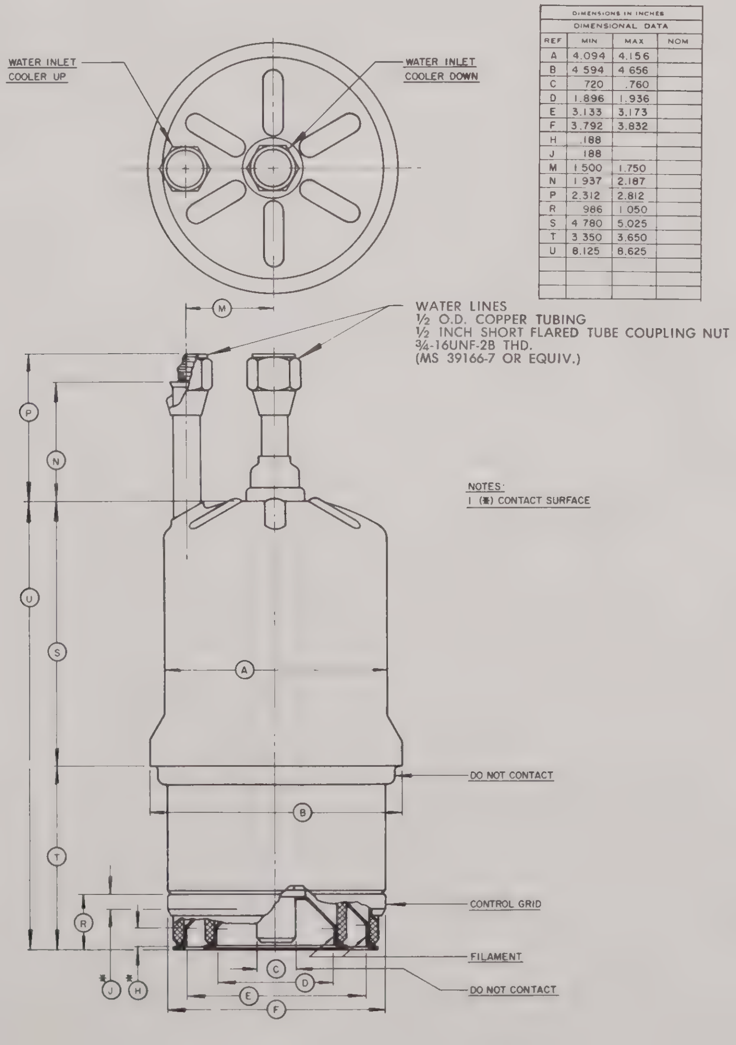
CLASS A DERATING TABLE	
DC Plate Voltage (Volts)	Max. DC Plate Current (mA)
0 - 2400	5000
3000	4000
4000	3000
5000	2000
6000	1500
7000	1000
8000	700
9000	500
10,000	350

Filament Operation—The rated filament voltage for the 3CW20,000A1 is 7.5 volts. Filament voltage, as measured at the socket, should not be allowed to deviate from the rated value by more than plus or minus five percent.

Cooling—The maximum temperature rating for the external surfaces of the 3CW20,000A1 is 250°C. Sufficient water and forced-air cooling must be provided to maintain the temperature of the ceramic-metal seals and anode core below 250°C. Tube life is usually prolonged if these areas are maintained at temperatures below this maximum rating. Minimum water-flow requirements for adequate cooling are listed on the preceding page. Forced air cooling is required for the base and grid seals and is accomplished by directing approximately 30 cfm of air through the socket and over the seals.

Grid Dissipation—Grid Dissipation is limited to 100 watts. This is the product of dc grid current and peak positive grid voltage.

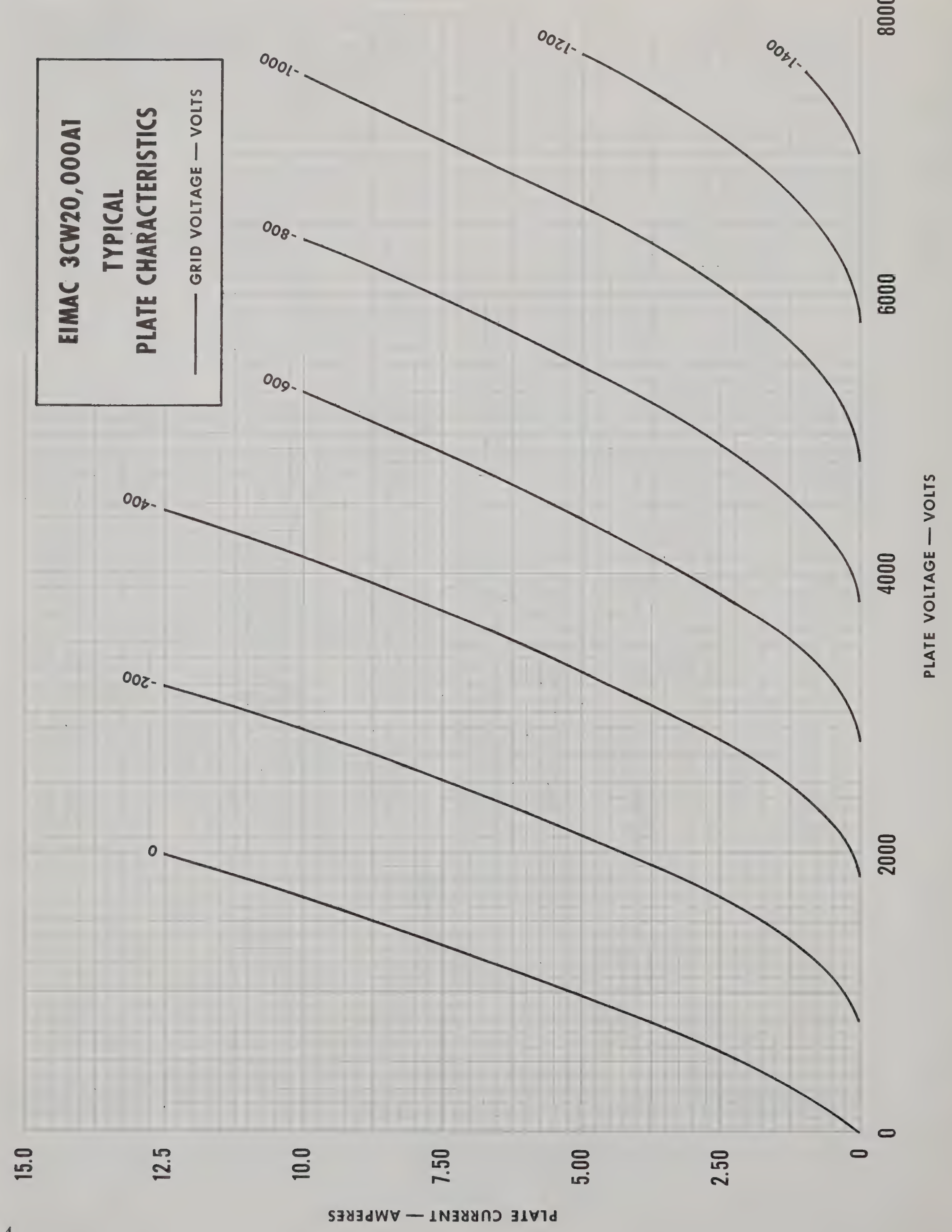
Special Applications—If it is desired to operate this tube under conditions widely different from those given here, write to Power Grid Tube Marketing, EIMAC Division of Varian, 301 Industrial Way, San Carlos, Calif., for information and recommendations.



WATER LINES
½ O.D. COPPER TUBING
½ INCH SHORT FLARED TUBE COUPLING NUT
¾-16UNF-2B THD.
(MS 39166-7 OR EQUIV.)

NOTES:
1 (✱) CONTACT SURFACE

DIMENSIONS IN INCHES			
DIMENSIONAL DATA			
REF	MIN	MAX	NOM
A	4.094	4.156	
B	4.594	4.656	
C	.720	.760	
D	1.896	1.936	
E	3.133	3.173	
F	3.792	3.832	
H	.188		
J	.188		
M	1.500	1.750	
N	1.937	2.187	
P	2.312	2.812	
R	.986	1.050	
S	4.780	5.025	
T	3.350	3.650	
U	8.125	8.625	


EIMAC 3CW20,000A1
TYPICAL
PLATE CHARACTERISTICS
— GRID VOLTAGE — VOLTS
0
-200
-400
-600
-800
-1000
-1200
-1400
PLATE CURRENT — AMPERES
15.0
12.5
10.0
7.50
5.00
2.50
0
PLATE VOLTAGE — VOLTS
0
2000
4000
6000
8000

Eimac

EITEL-McCULLOUGH, INC.
SAN CARLOS, CALIFORNIA

3CW20,000A3

WATER-COOLED MEDIUM-MU POWER TRIODE

The Eimac 3CW20,000A3 is a ceramic and metal power triode intended primarily for use as a power oscillator in industrial-heating applications. It is also recommended for use as a grounded-grid FM amplifier, as a conventional plate-modulated amplifier, or as a linear amplifier.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated-Tungsten	Min.	Nom.	Max.	
Voltage		7.5		volts
Current	94		104	amperes
Amplification Factor		20		
Interelectrode Capacitances, Grounded Cathode:				
Input	48		58	uuf
Output	1.2		1.5	uuf
Feedback	30		38	uuf
Frequency for Maximum Ratings			140	Mc

MECHANICAL

Base	Coaxial
Recommended Socket	Eimac SK-1300
Operating Position	Vertical, base up or down
Cooling	Water and Forced air
Maximum Operating Temperatures:	
Anode Core	250°C
Ceramic-to-Metal Seals	250°C
Maximum Dimensions:	
Height	11.4 inches
Diameter	4.7 inches
Net Weight	12 pounds

RADIO-FREQUENCY INDUSTRIAL OSCILLATOR

Class-C

MAXIMUM RATINGS

DC PLATE VOLTAGE	7000 MAX. VOLTS
DC PLATE CURRENT	4.0 MAX. AMPS
PLATE DISSIPATION	20 MAX. KW
GRID DISSIPATION	250 MAX. WATTS

TYPICAL OPERATION, Optimum Load

DC Plate Voltage	6000	7000 volts
DC Grid Voltage	-575	-670 volts
DC Plate Current	4.0	4.0 amps
DC Grid Current	610	670 mA
Plate Input Power	24	28 kW
Plate Output Power	18.9	22.4 kW

RADIO-FREQUENCY POWER AMPLIFIER

Grounded-Grid, Class C

MAXIMUM RATINGS

DC PLATE VOLTAGE	7000 MAX. VOLTS
DC PLATE CURRENT	4.0 MAX. AMPS
PLATE DISSIPATION	20 MAX. KW
GRID DISSIPATION	250 MAX. WATTS

TYPICAL OPERATION

DC Plate Voltage	6000	7000 volts
DC Grid Voltage	-535	-625 volts
DC Plate Current	4.0	4.0 amps
DC Grid Current	545	530 mA
Driving Power	3700	4100 watts
Plate Output Power	20.5	24.5 kW

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RADIO-FREQUENCY POWER AMPLIFIER PLATE-MODULATED

Class-C

MAXIMUM RATINGS

DC PLATE VOLTAGE	5500 MAX. VOLTS
DC PLATE CURRENT	3.0 MAX. AMPS
PLATE DISSIPATION	13.5 MAX. KW
GRID DISSIPATION	250 MAX. WATTS

TYPICAL OPERATION

DC Plate Voltage	4000	5000	volts
DC Grid Voltage	-480	-600	volts
DC Plate Current	3.0	3.0	amps
DC Grid Current	660	550	mA
Driving Power	530	515	watts
Plate Output Power	9.7	12.4	kW

RADIO-FREQUENCY LINEAR AMPLIFIER

Grounded-Grid, Class-AB_2

MAXIMUM RATINGS

DC PLATE VOLTAGE	7000 MAX. VOLTS
DC PLATE CURRENT	5.0 MAX. AMPS
PLATE DISSIPATION	20 MAX. KW
GRID DISSIPATION	250 MAX. WATTS

TYPICAL OPERATION

DC Plate Voltage	6000	7000	volts
DC Grid Voltage*	-270	-325	volts
Zero-Sig Plate Current	500	500	mA
Max-Sig DC Plate Current	4.0	4.0	amps
Max-Sig DC Grid Current	300	250	mA
Peak RF Grid Voltage	540	585	volts
Driving Power	1900	2050	watts
Plate Output Power	18	20	kW

*Adjust to give specified zero-signal dc plate current

Note: "TYPICAL OPERATION" data are obtained by calculation from published characteristic curves and confirmed by direct tests. No allowance for circuit losses, either input or output, has been made.

APPLICATION

MECHANICAL

Mounting—The 3CW20,000A3 must be operated vertically, base down or up. The tube must be protected from severe vibration and shock.

Socket—The SK-1300 socket is available for use with the 3CW20,000A3. Base cooling is accomplished by directing approximately 30 cfm of air at a static pressure of 0.1 inch through the socket and over the base seals.

Cooling—The anode of the 3CW20,000A3 is cooled by circulating water through the integral anode-water jacket. The table below lists minimum water-flow rates at various plate dissipation levels.

Minimum Cooling Water-Flow Requirements

Plate Dissipation (kW))	Water Flow (gpm)	Pressure Drop (psi)
10	6.3	4.9
15	9.0	9.2
20	12.0	15.0

Since power dissipated by the filament represents 750 watts and grid dissipation can reach 250 watts, 1000 watts has been added to anode dissipation in preparing this tabulation.

The cooling table assumes that the maximum outlet-water temperature will be below 70°C to preclude "spot" boiling. Further, the inlet-water temperature must not exceed 60°C. In all cases, maximum system water pressure must be below 50 pounds per square inch. Water flow and air flow must be started before applying any voltages to the tube and may be stopped simultaneously with the removal of tube voltages. Suitable flow and temperature interlocks should be provided to protect the tube from inadequate flow rates.

ELECTRICAL

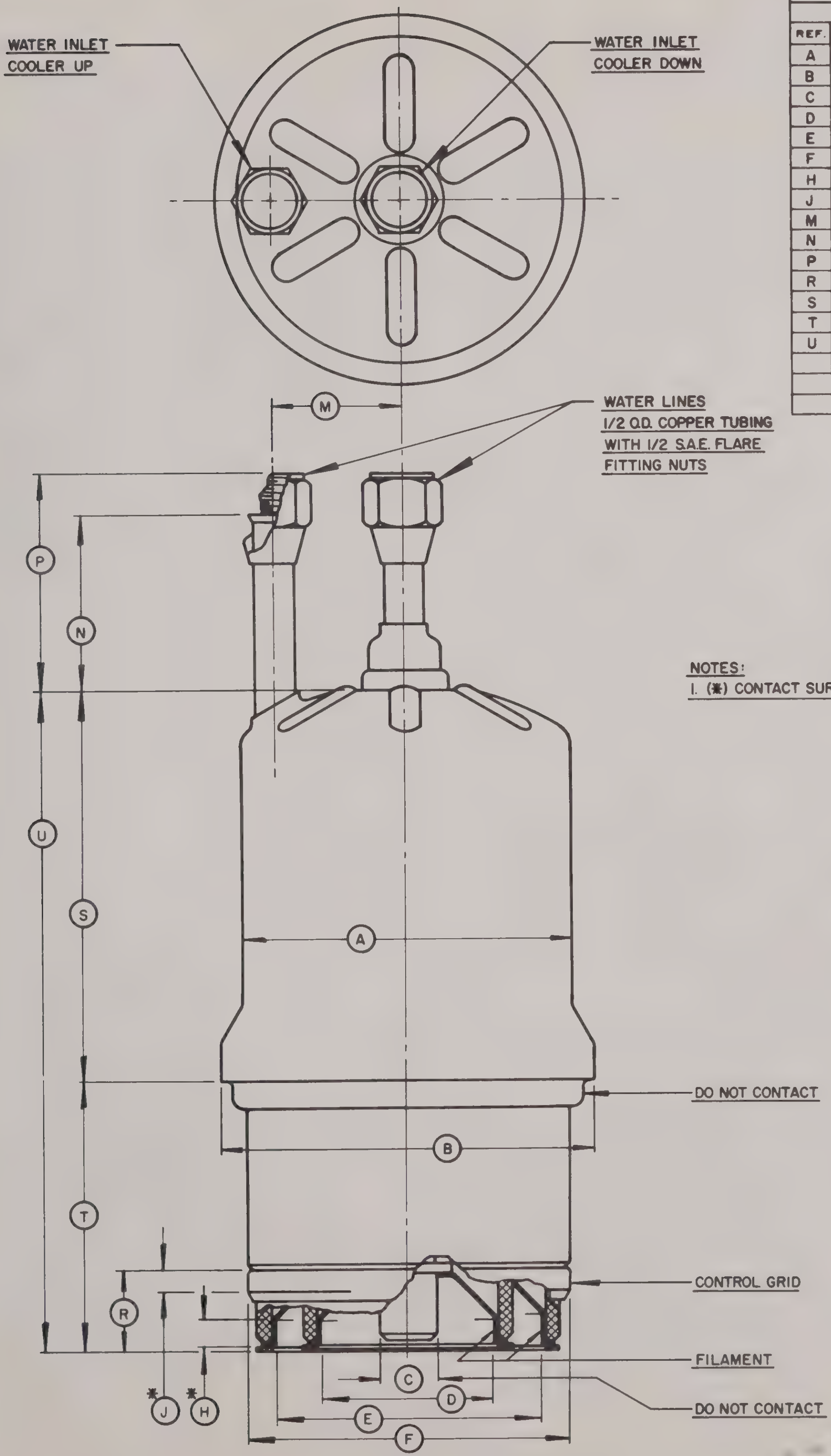
Filament — The rated filament voltage for the 3CW20,000A3 is 7.5 volts. Filament voltage, as measured at the socket, should be maintained at this value for consistent performance and maximum tube life. In no case should it be allowed to vary from 7.5 volts by more than plus or minus five percent.

Grid Dissipation—The rated grid dissipation of the 3CW20,00A3 is 250 watts. Grid Dissipation is the approximate product of dc grid current and peak positive grid voltage. In equipment where plate loading varies widely, such as radio-frequency heating oscillators, care should be taken to insure that grid dissipation does not exceed the 250 watt maximum.

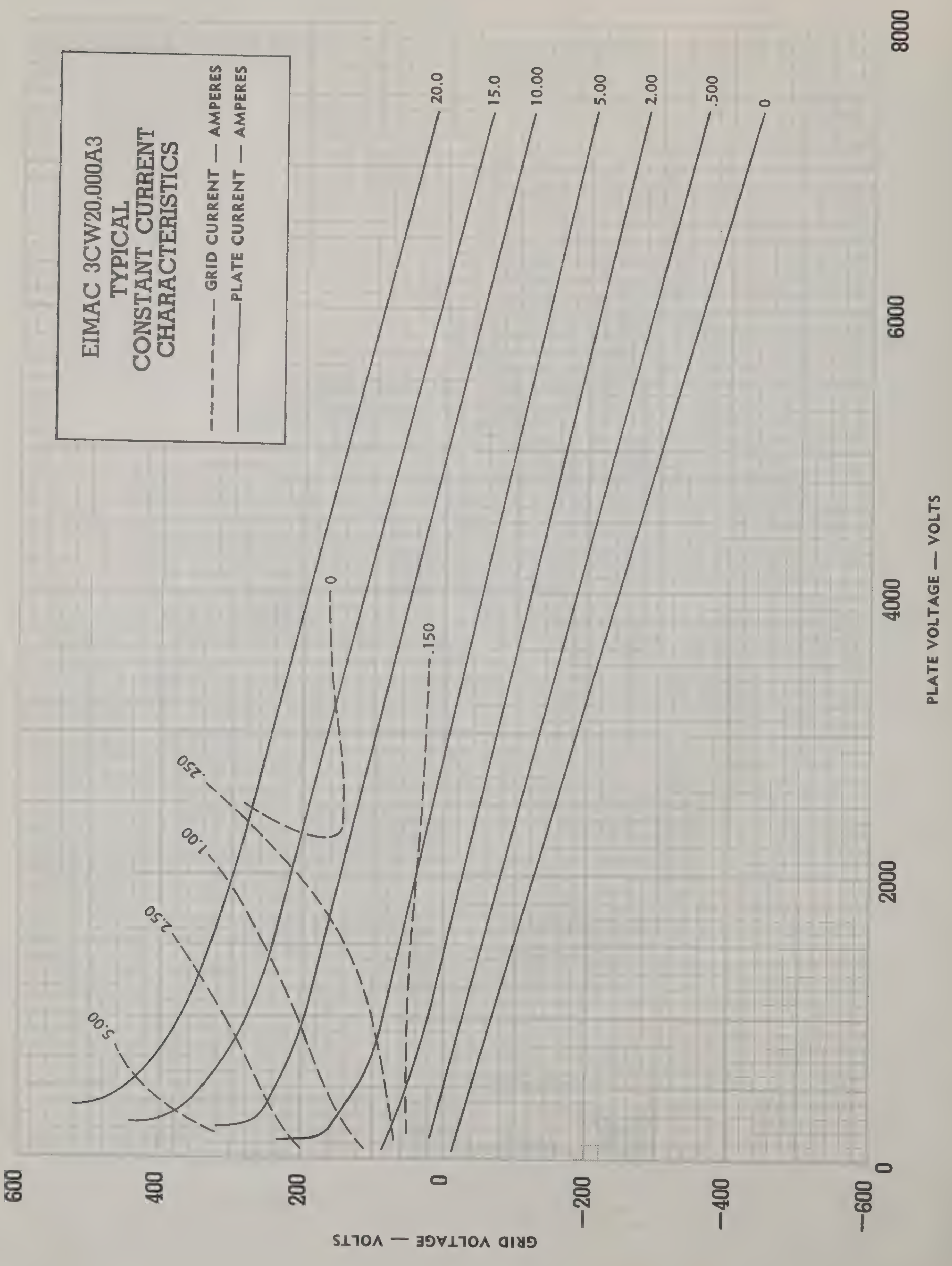
Plate Operation—Plate input is limited to 28 kilowatts in Class-C and Class-AB applications. In Class-C, plate-modulated applications, this rating is reduced to 15 kilowatts. The 20 kilowatt anode dissipation capability provides a large margin of safety in most applications.

Special Applications—If it is desired to operate this tube under conditions widely different from those given here, write to Power Grid Tube Marketing, Eitel-McCullough, Inc., 301 Industrial Way, San Carlos, California, for information and recommendations.

DIMENSIONS IN INCHES			
DIMENSIONAL DATA			
REF.	MIN.	MAX.	NOM.
A	4.094	4.156	
B	4.594	4.656	
C	.720	.760	
D	1.896	1.936	
E	3.133	3.173	
F	3.792	3.832	
H	.188		
J	.188		
M	1.500	1.750	
N	1.937	2.187	
P	2.312	2.812	
R	.986	1.050	
S	4.780	5.025	
T	3.350	3.650	
U	8.125	8.625	



NOTES:
1. (*) CONTACT SURFACE



EIMAC 3CW20,000A3
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS

EITEL-McCULLOUGH, INC.
SAN CARLOS, CALIFORNIA

3CW20,000A7

WATER-COOLED
HIGH-MU
POWER TRIODE

The Eimac 3CW20,000A7 is a ceramic and metal power triode intended to be used as a zero-bias Class-B amplifier in audio or radio-frequency applications. Operation with zero grid bias offers circuit simplicity by eliminating the bias supply. In addition, grounded-grid operation is attractive since a power gain as high as twenty times can be obtained with the 3CW20,000A7.

The 3CW20,000A7 is electrically identical to the air-cooled 3CX10,000A7 except for its 20kW plate dissipation rating.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated-Tungsten	Min.	Nom.	Max.	
Voltage		7.5		volts
Current	94		104	amperes
Amplification Factor		200		

Direct Interelectrode Capacitances:	Min.	Max.
Grid-Filament	50.0	62.0 uuf
Grid-Plate	32.0	40.0 uuf
Plate-Filament		0.3 uuf
Frequency for Maximum Ratings		140 Mc

MECHANICAL

Base	Coaxial
Recommended Socket	Eimac SK-1300
Operating Position	Vertical, base up or down
Cooling	Water and Forced air
Maximum Operating Temperatures:	
Anode Core	250° C
Ceramic-to-Metal Seals	250° C
Maximum Dimensions:	
Height	11.4 inches
Diameter	4.7 inches
Net Weight	12 pounds

RADIO-FREQUENCY LINEAR AMPLIFIER

Grounded Grid, Class-B

MAXIMUM RATINGS

DC PLATE VOLTAGE	7000 MAX. VOLTS
DC PLATE CURRENTS	5.0 MAX. AMPS
PLATE DISSIPATION	20 MAX. KW
GRID DISSIPATION	500 MAX. WATTS

*Approximate Values

TYPICAL OPERATION, Single-Tone Conditions		
DC Plate Voltage	7000	7000 volts
Zero-Sig DC Plate Current*	0.60	0.60 amps
Max-Sig DC Plate Current	3.72	5.00 amps
Max-Sig DC Grid Current	0.71	1.00 amp
Driving Impedance	35	32 ohms
Resonant Load Impedance	1020	745 ohms
Max-Sig Driving Power	885	1540 watts
Peak Envelope Plate Output Power	17,700	24,200 watts
Power Gain	20.0	15.7 times

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AUDIO-FREQUENCY AMPLIFIER OR MODULATOR

Class-B, Grid Driven

MAXIMUM RATINGS (Per Tube)

DC PLATE VOLTAGE	7000 MAX. VOLTS
DC PLATE CURRENT	5.0 MAX. AMPS
PLATE DISSIPATION	20 MAX. KW
GRID DISSIPATION	500 MAX. WATTS

*Approximate Values

TYPICAL OPERATION, Two Tubes, Sinusoidal Wave

DC Plate Voltage	5000	7000 volts
DC Grid Voltage	0	0 volts
Zero-Sig DC Plate Current*	1.2	1.2 amps
Max-Sig DC Plate Current	10.0	10.0 amps
Max-Sig DC Grid Current	1.2	2.1 amps
Driving Power	290	560 watts
Peak AF Driving Voltage (Per Tube)	240	310 volts
Load Resistance, Plate-to-Plate	1030	1520 ohms
Max-Sig Plate Output Power	31,000	47,700 watts

RADIO-FREQUENCY LINEAR AMPLIFIER

Carrier Conditions, Grounded-Grid, Class-B_2

MAXIMUM RATINGS

DC PLATE VOLTAGE	7000 MAX. VOLTS
DC PLATE CURRENT	5.0 MAX. AMPS
PLATE DISSIPATION	20 MAX. KW
GRID DISSIPATION	500 MAX. WATTS

*Approximate Values
†Modulation Crest Conditions

TYPICAL OPERATION

DC Plate Voltage	7000 volts
DC Grid Voltage	0 volts
Zero-Sig DC Plate Current*	0.6 amp
DC Plate Current	2.4 amps
DC Grid Current	0.25 amp
Driving Impedance†	32 ohms
Peak Driving Voltage†	310 volts
Driving Power	330 watts
Plate Output Power	5650 watts

RADIO-FREQUENCY POWER AMPLIFIER OR OSCILLATOR, Class-C

MAXIMUM RATINGS

DC PLATE VOLTAGE	7000 MAX.VOLTS
DC PLATE CURRENT	4.0 MAX. AMPS
PLATE DISSIPATION	20 MAX. KW
GRID DISSIPATION	500 MAX. WATTS

TYPICAL OPERATION

DC Plate Voltage	5000	7000 volts
DC Plate Current	4.0	4.0 amps
DC Grid Voltage	-210	-230 volts
DC Grid Current	840	775 mA
Peak RF Grid Voltage	510	555 volts
Grid Driving Power	420	530 watts
Plate Output Power	14	21.3 kW

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER, Class-C

MAXIMUM RATINGS

DC PLATE VOLTAGE	5500 MAX. VOLTS
DC PLATE CURRENT	3.0 MAX. AMPS
PLATE DISSIPATION†	13.5 MAX. KW
GRID DISSIPATION	500 MAX. WATTS

†Corresponds to 20 kW at 100% sine-wave modulation

TYPICAL OPERATION

DC Plate Voltage	5000 volts
DC Plate Current	3.0 amps
DC Grid Voltage	-200 volts
DC Grid Current	775 mA
Peak RF Grid Voltage	490 volts
Grid Driving Power	380 watts
Plate Output Power	11.9 kW

Note: "TYPICAL OPERATION" data are obtained by calculation from published characteristic curves and confirmed by direct tests. No allowance for circuit losses, either input or output, has been made. Adjustment of the rf grid drive to obtain the specified zero-signal plate current at the specified bias and plate voltage is assumed.

APPLICATION

MECHANICAL

Mounting—The 3CW20,000A7 must be operated vertically, base down or up. The tube must be protected from severe vibration and shock.

Socket—The SK-1300 socket is available for use with the 3CW20,000A7. Base cooling is accomplished by directing approximately 30 cfm of air at a static pressure of 0.1 inch through the socket and over the base seals.

Cooling—The anode of the 3CW20,000A7 is cooled by circulating water through the integral anode-water jacket. The table below lists minimum water-flow rates at various plate dissipation levels and water-inlet temperatures.

Minimum Cooling Water-Flow Requirements

25° Inlet Water

Plate Dissipation (kW))	Water Flow (gpm)	Pressure Drop (psi)
10	6.3	4.9
15	9.0	9.2
20	12.0	15.0

°Since power dissipated by the filament represents 750 watts and grid dissipation can reach 500 watts, 1250 watts has been added to anode dissipation in preparing this tabulation.

The cooling table assumes that the maximum outlet-water temperature will be below 70°C to preclude "spot" boiling. Further, inlet-water temperature must not exceed 60°C. In all cases, maximum system water pressure must not exceed 50 pounds per square inch. Water flow and air flow must be started before applying any voltages to the tube and may be stopped simultaneously with the removal of tube voltages. Suitable flow and temperature interlocks should be provided to protect the tube from inadequate flow rates.

ELECTRICAL

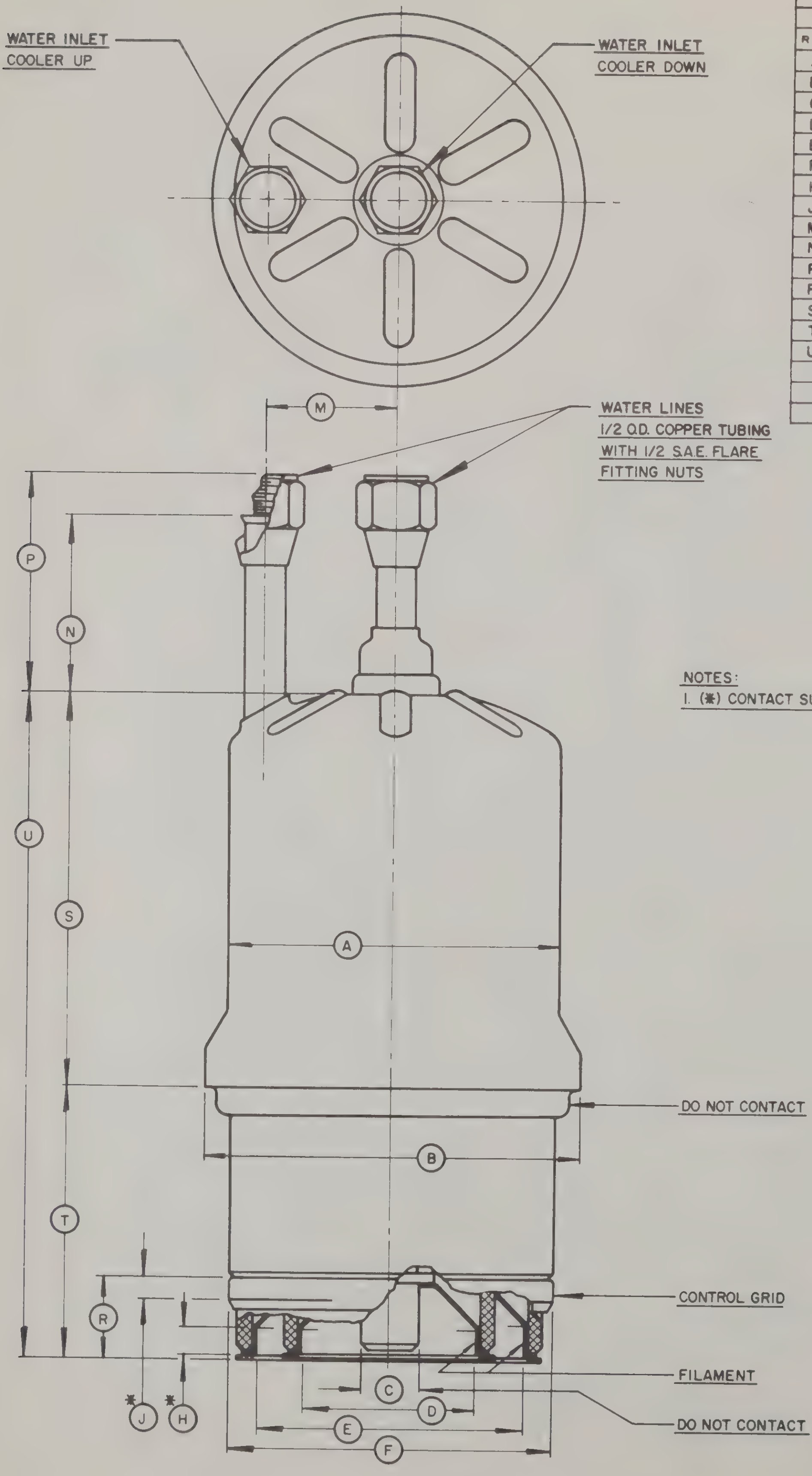
Filament—The rated filament voltage for the 3CW20,-000A7 is 7.5 volts Filament voltage, as measured at the socket, should be maintained at this value for consistent performance and maximum tube life. In no case should it be allowed to vary from 7.5 volts by more than plus or minus five percent.

Input Circuit—When the 3CW20,000A7 is operated as a grounded-grid rf amplifier, the use of a resonant tank line in the cathode circuit is recommended in order to obtain greatest linearity and power output. For best results with a single-ended amplifier, it is suggested that the cathode tank circuit operate at a "Q" of two or more.

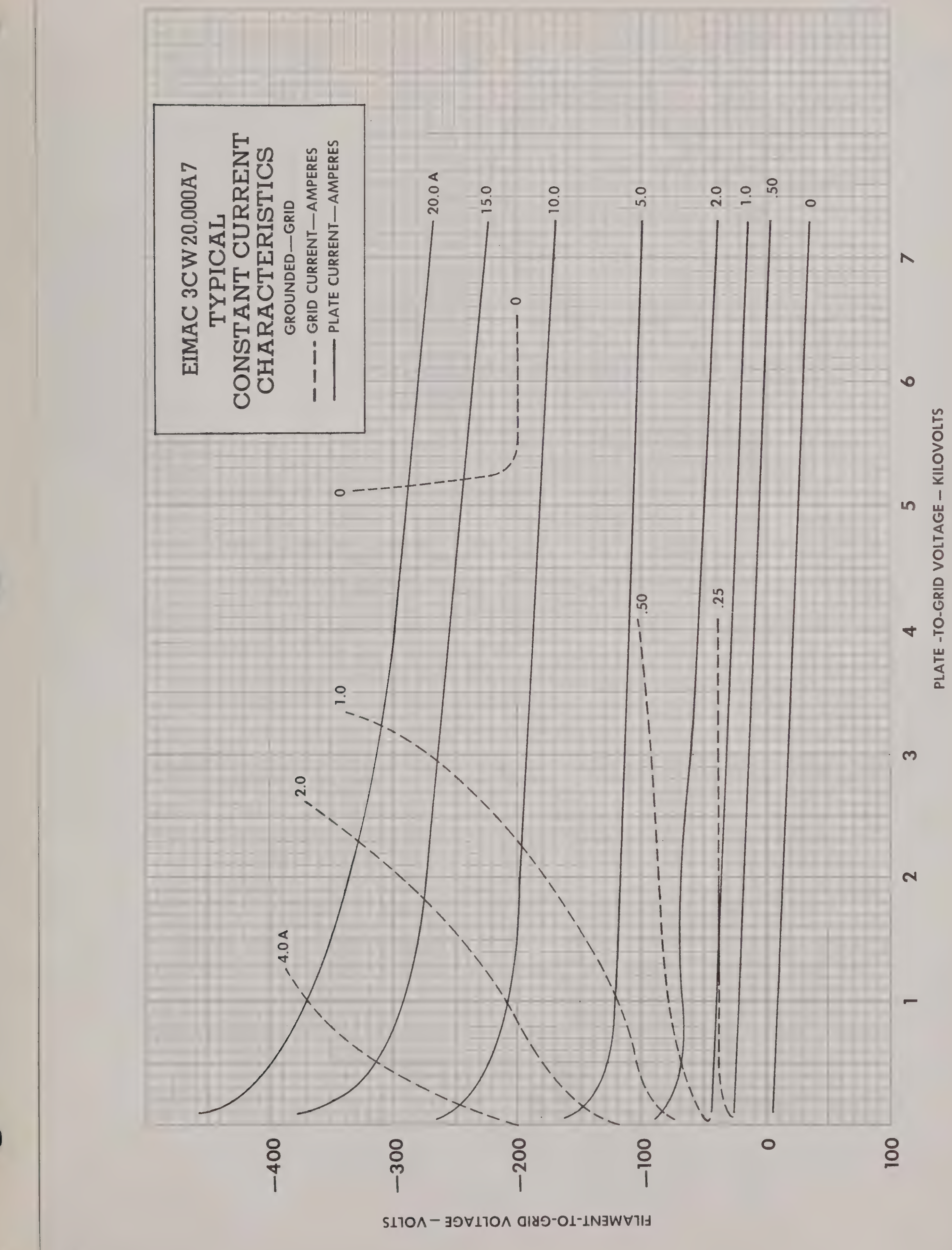
Class-C Operation—Although designed specifically for Class-B service, the 3CW20,000A7 may be operated as a Class-C amplifier or oscillator or as a plate-modulated radio-frequency amplifier. The zero-bias characteristic can be used to advantage in Class-C amplifiers by employing only grid leak bias. If driving power should fail, plate dissipation is then kept to a low value because the tube will be operating at normal, static, zero-bias conditions.

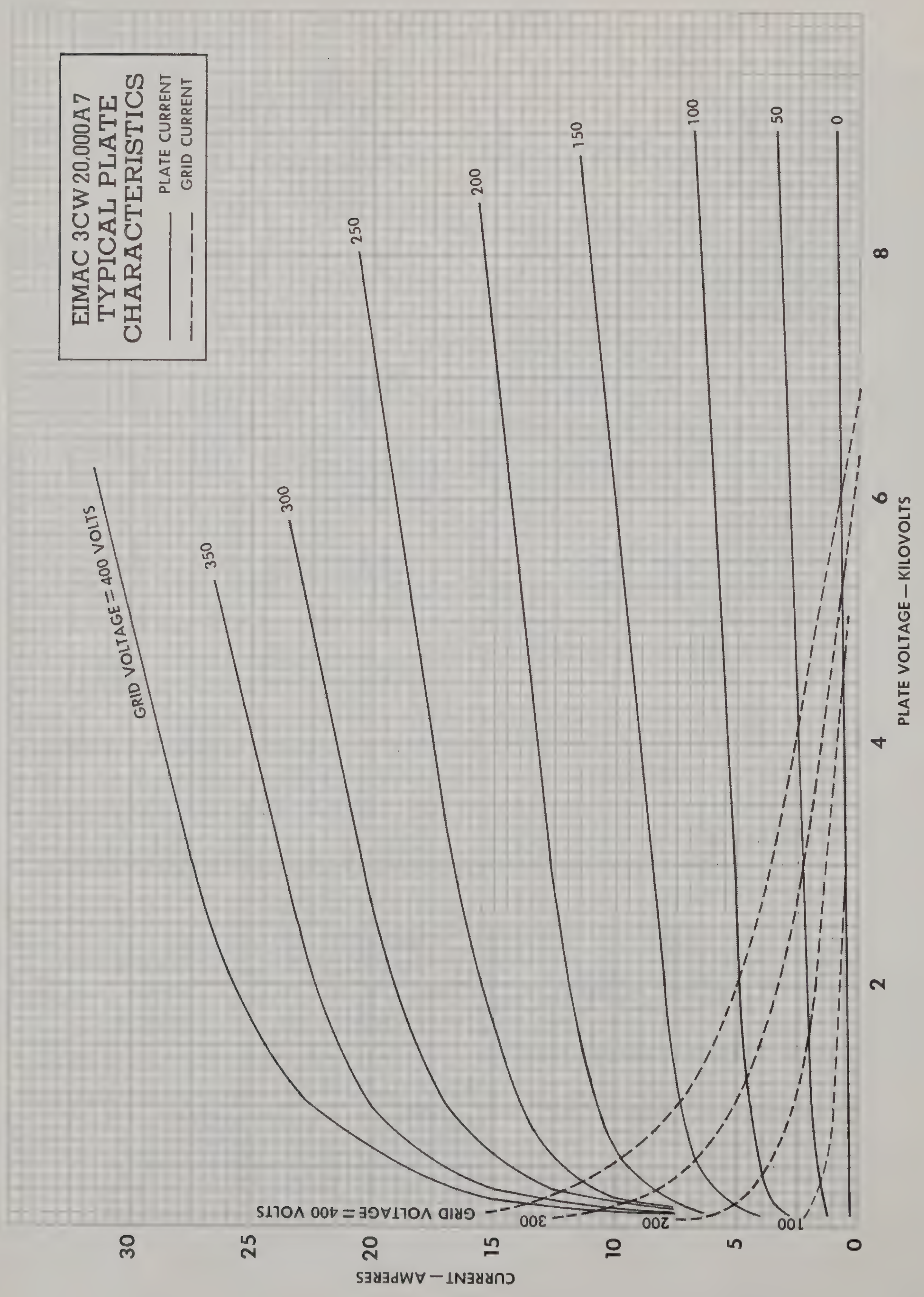
Special Applications—If it is desired to operate this tube under conditions widely different from those given here, write to Power Grid Tube Marketing, Eitel-McCullough, Inc., 301 Industrial Way, San Carlos, California, for information and recommendations.

DIMENSIONS IN INCHES			
DIMENSIONAL DATA			
REF.	MIN.	MAX.	NOM.
A	4.094	4.156	
B	4.594	4.656	
C	.720	.760	
D	1.896	1.936	
E	3.133	3.173	
F	3.792	3.832	
H	.188		
J	.188		
M	1.500	1.750	
N	1.937	2.187	
P	2.312	2.812	
R	.986	1.050	
S	4.780	5.025	
T	3.350	3.650	
U	8.125	8.625	



NOTES:
1. (✱) CONTACT SURFACE


EIMAC 3CW20,000A7
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
GROUNDED—GRID
GRID CURRENT—AMPERES
PLATE CURRENT—AMPERES
20.0 A
15.0
10.0
5.0
2.0
1.0
.50
0
0
0
1.0
2.0
4.0 A
.50
.25
1
2
3
4
5
6
7
PLATE -TO-GRID VOLTAGE — KILOVOLTS
−400
−300
−200
−100
0
100
FILAMENT-TO-GRID VOLTAGE — VOLTS


EIMAC 3CW 20,000A7
TYPICAL PLATE
CHARACTERISTICS
PLATE CURRENT
GRID CURRENT
GRID VOLTAGE = 400 VOLTS
350
300
250
200
150
100
50
0
GRID VOLTAGE = 400 VOLTS
300
200
100
CURRENT — AMPERES
0
5
10
15
20
25
30
PLATE VOLTAGE — KILOVOLTS
2
4
6
8

EIMAC
Division of Varian
SAN CARLOS
CALIFORNIA

3CW40,000H3
MEDIUM-MU

WATER-COOLED
POWER TRIODE

The EIMAC 3CW40,000H3 is a water-cooled, ceramic-metal power triode designed primarily for use in industrial radio-frequency heating services. Its water-cooled anode is conservatively rated at 40 kilowatts of plate dissipation with low waterflow and pressure drop.

Input of 80 kilowatts is permissible up to 90 megahertz. Plentiful reserve emission is available from its 1500 watt filament. The grid structure is rated at 750 watts, making this tube an excellent choice for severe applications.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated-Tungsten	Min.	Nom.	Max.	
Voltage		10		volts
Current	152		168	amps
Amplification Factor		20		
Interelectrode Capacitances, Grounded Cathode:				
Grid-Filament	65		75	pF
Plate-Filament	2.0		2.6	pF
Grid Plate	38		48	pF
Frequency for Maximum Ratings			90	MHz

MECHANICAL

Base	See Outline
Operating Position	Vertical, base up or down
Cooling	Water and Forced Air
Maximum Operating Temperatures:	
Ceramic-to-Metal Seals	250°C
Maximum Dimensions:	
Height	See Outline
Diameter	See Outline
Net Weight	14 pounds

(Effective 8-1-67) © 1967 Varian

Printed in U.S.A.

RF INDUSTRIAL OSCILLATOR

Class-C (Filtered DC Power Supply)

MAXIMUM RATINGS

DC PLATE VOLTAGE	12,000 VOLTS
DC PLATE CURRENT	9.0 AMPS
DC GRID VOLTAGE	–1200 VOLTS
DC GRID CURRENT	1.2 AMPS
PLATE INPUT POWER	100 KW
PLATE DISSIPATION	40 KW

TYPICAL OPERATION*

DC Plate Voltage	7000	10,000	volts
DC Plate Current	7.7	9.0	amps
DC Grid Voltage	–700	–850	volts
DC Grid Current	.53	.742	amps
Peak Positive Grid Voltage	440	550	volts
Driving Power	600	1040	watts
Plate Input Power	54	90	kW
Plate Dissipation	16	20	kW
Plate Output Power	37.7	70	kW
Approximate Load Impedance	408	526	ohms

*Loaded Conditions

Note: "TYPICAL OPERATION" data are obtained by calculation from published characteristic curves and confirmed by direct tests. No allowance for circuit losses, either input or output, has been made.

APPLICATION

ELECTRICAL

Filament — The rated filament voltage for the 3CW40,000H3 is 10.0 volts. Filament voltage, as measured at the tube, should be maintained at this value for consistent performance and maximum tube life. In no case should it be allowed to vary from 10.0 volts by more than plus or minus five percent.

Control Grid Operation — The grid current rating is 1.2 ampere dc. This value should not be exceeded for more than very short periods such as during tuning and over-current protection in the grid circuit should be provided. Ordinarily it will not be necessary to operate with more than 0.3 to 0.6 amp grid current to obtain reasonable efficiency. In industrial heating service with varying loads, grid current should be monitored continuously with a dc current meter. The maximum grid dissipation rating is 750 watts.

Plate Operation — Maximum plate voltage rating of 12,000 volts and maximum plate current of 9.0 amps should not be applied simultaneously as rated plate dissipation may be exceeded. The 100 kilowatts input rating applies for Class-C amplifier or oscillator service with no modulation.

Plate over-current protection should be provided to remove plate voltage quickly in the event of an over-load or an arc-over at the load. In addition current limiting power supply resistors should be used. These precautions are especially important in industrial service with its wide variations in loading.

Spark gaps from plate to ground should be used to prevent transient voltages from flashing across the tube envelope during any fault conditions.

High Frequency Operation — The 3CW40,000H3 is usable to 120 MHz. At this frequency, plate voltage must be reduced to 7000 volts in Class-C service.

MECHANICAL

Mounting — The 3CW40,000H3 must be mounted vertically, either base up or down.

Cooling — The anode of the 3CW40,000H3 is cooled by circulating water through the integral anode-water jacket. The table below lists minimum water-flow rates at various plate dissipation levels. The table is based on a water temperature rise of 15°C.

MINIMUM COOLING WATER-FLOW REQUIREMENTS

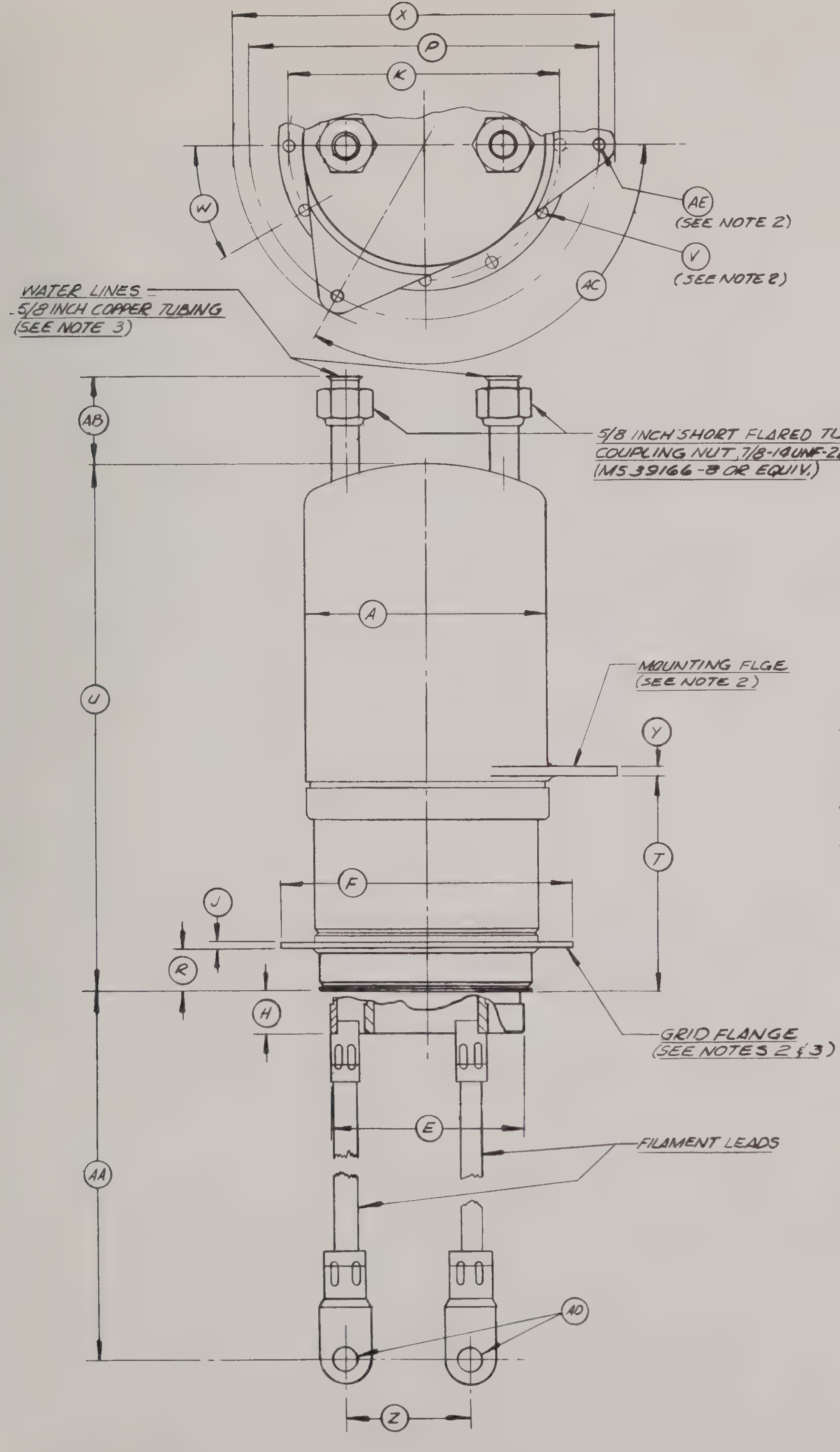
Plate Dissipation (kW)	Water Flow (gpm)	Pressure Drop (psi)
20	5.25	4.0
30	7.6	6.5
40	10.2	13.0
50	12.6	21.0

Since power dissipated by the filament represents 1500 watts and grid dissipation can reach 750 watts, 2250 watts has been added to anode dissipation in preparing this tabulation.

The cooling table assumes that the maximum outlet-water temperature will be below 70°C to preclude "spot" boiling.

Additional stem cooling air must be provided. 20 CFM of air directed against the center filament contact ring ½" below the outer filament contact ring by a 1½" I.D. air duct arranged at a 45° angle with the center line of the tube will provide adequate cooling for maximum frequency of 30 MHz, 50°C ambient, and 5000 ft. altitude.

Special Application — If it is desired to operate this tube under conditions widely different from those given here, write to Power Grid Product Manager, EIMAC Division of Varian, 301 Industrial Way, San Carlos, California 94070, for information and recommendations.

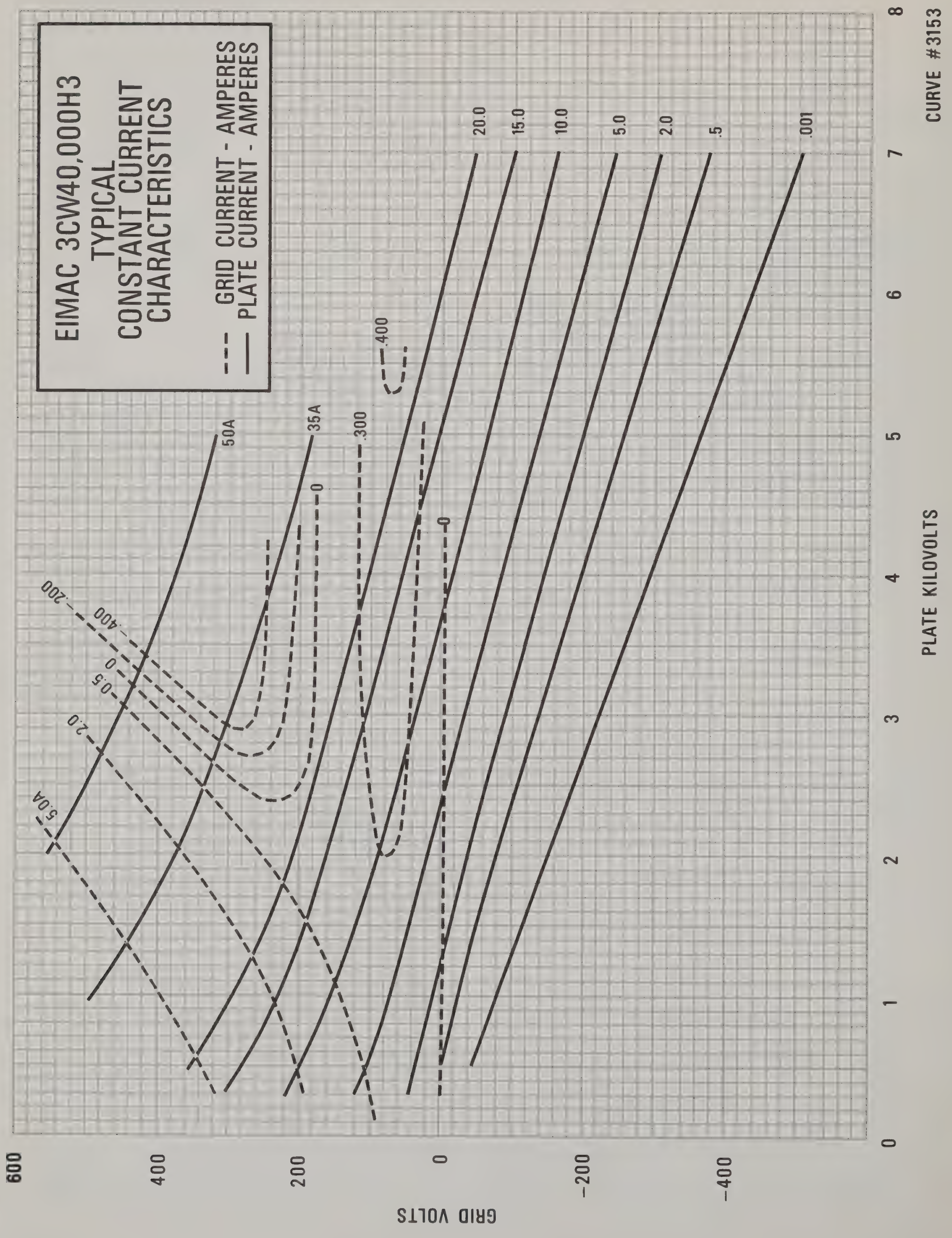


DIMENSIONS IN INCHES

DIMENSIONAL DATA			
DIM	MIN.	MAX.	REF
A	4.250	4.375	
E	3.230	3.270	
F	5.030	5.090	
H	.530	.700	
J			.125
K	4.425	4.445	
M			2.750
P	5.850	5.900	
R	.700	.860	
T	4.050	4.160	
U	9.800	10.050	
V			.250
W	29°	31°	
X			6.750
Y			.250
Z			2.000
AA	8.500	9.000	
AB			2.625
AC	118°	122°	
AD			.390
AE			.312

NOTES:

1. REF. DIMS. ARE FOR INFORMATION ONLY & ARE NOT REQ'D FOR INSPECTION PURPOSES.
2. 3 MTG. HOLES IN MTG. FLANGE & 12 IN THE GRID FLANGE
3. GRID FLGE, WATER FITTINGS & FIL. LEADS ORIENTED AS SHOWN.


EIMAC 3CW40,000H3
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
GRID CURRENT - AMPERES
PLATE CURRENT - AMPERES
50A
35A
20.0
15.0
10.0
5.0
2.0
.5
.001
.300
.400
0
0
.200
.400
0
0.5
2.0
5.0A
GRID VOLTS
600
400
200
0
−200
−400
PLATE KILOVOLTS
0
1
2
3
4
5
6
7
8
CURVE #3153

Eimac®

EITEL-McCULLOUGH, INC.
[illegible]

7289
3CX100A5
8250
3CX100F5
HIGH-MU UHF TRIODES

The Eimac 7289/3CX100A5 and 8250/3CX100F5 are ceramic-and-metal planar UHF triodes intended to supersede 2C39 types. The 7289/3CX100A5 has a 6.0-volt heater, while the 8250/3CX100F5 has a 26.5-volt heater. They are manufactured to exacting dimensional tolerances to provide the greatest mechanical uniformity. Extended and critical electrical testing results in increased reliability and a minimum variation in electrical characteristics. Full ratings apply at altitudes up to 60,000 feet and they are capable of sustained, reliable operation at elevated temperatures.

The mechanical and electrical characteristics of these tubes make them desirable for grid isolation circuits in cavity devices. They will deliver 27 watts of useful power at 500 megacycles and at 2900 megacycles, 9.5 watts of useful power can be realized.

GENERAL CHARACTERISTICS

ELECTRICAL

	MIN.	NOM.	MAX.	
Cathode: Oxide-coated, Unipotential				
Heating time			60	Seconds
Heater				
3CX100A5 Voltage (see applications)		6.0		Volts
Current ($E_f = 6.0$ volts)	0.90		1.05	Amperes
3CX100F5 Voltage (see applications)		26.5		Volts
Current ($E_f = 26.5$ volts)	0.20		0.24	Amperes
Amplification Factor		100		
Transconductance ($I_b = 70$ milliamperes)		25,000		Micromhos
Direct Interelectrode Capacitance				
C_{gk}	5.6		7.0	μμf
C_{gp}	1.95		2.15	μμf
C_{pk}			0.035	μμf
Frequency for Maximum Ratings			2500	Megacycles

MECHANICAL

Terminals: Graduated Cylindrical Surfaces	
Maximum Operating Temperatures	
Ceramic to Metal Seals	250°C (300°C short term overload value)
Anode Core	250°C (300°C short term overload value)
Operating Position	Any
Cooling	Forced Air
Maximum Overall Dimensions	
Length	2.701 Inches Max.
Diameter	1.264 Inches Max.
Net Weight	2.5 Ounces
Shipping Weight (approx.)	7.0 Ounces

RADIO FREQUENCY POWER AMPLIFIER OR OSCILLATOR

MAXIMUM RATING (Per Tube)

DC PLATE VOLTAGE	1000 VOLTS	MAX.
DC CATHODE CURRENT	0.125 AMP.	MAX.
DC GRID VOLTAGE	—150 VOLTS	MAX.
DC GRID CURRENT	0.050 AMP.	MAX.
INSTANTANEOUS PEAK POSITIVE GRID VOLTAGE	30 VOLTS	MAX.
INSTANTANEOUS PEAK NEGATIVE GRID VOLTAGE	—400 VOLTS	MAX.
PLATE DISSIPATION	100 WATTS	MAX.
GRID DISSIPATION	2 WATTS	MAX.

TYPICAL OPERATION (Per Tube)

Power Amplifier
Grounded-Grid
(Key-down conditions)

	500 Mc	2500 Mc	2900 Mc	
DC PLATE VOLTAGE	800	900	1000	Volts
DC GRID VOLTAGE (approx.)	—20	—22	—9.5	Volts
DC PLATE CURRENT	80	90	100	Milliamp.
DC GRID CURRENT (approx.)	30	25	15	Milliamp.
DRIVING POWER (approx.)	6			Watts
USEFUL OUTPUT POWER	27	15	9.5	Watts

PLATE MODULATED RADIO FREQUENCY AMPLIFIER OR OSCILLATOR

MAXIMUM RATINGS (Per Tube)

DC PLATE VOLTAGE	600 VOLTS	MAX.
DC CATHODE CURRENT	0.100 AMP.	MAX.
DC GRID VOLTAGE	—150 VOLTS	MAX.
DC GRID CURRENT	0.050 AMP.	MAX.
INSTANTANEOUS PEAK POSITIVE GRID VOLTAGE	30 VOLTS	MAX.
INSTANTANEOUS PEAK NEGATIVE GRID VOLTAGE	—400 VOLTS	MAX.
PLATE DISSIPATION	70 WATTS	MAX.
GRID DISSIPATION	2 WATTS	MAX.

TYPICAL OPERATION (Per Tube)
500 Mc, Grounded-Grid, Carrier Conditions.

DC PLATE VOLTAGE	600 Volts
DC GRID VOLTAGE (approx.)	—15 Volts
DC PLATE CURRENT	65 Milliamp.
DC GRID CURRENT (approx.)	35 Milliamp.
DRIVING POWER (approx.)	5 Watts
USEFUL CARRIER POWER OUTPUT	16 Watts

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APPLICATION

MECHANICAL

Mounting — The 3CX100A5 and 3CX100F5 may be operated in any position. They should be firmly held in place by spring-finger collets bearing on the terminal surfaces. In use the tubes should seat against the under side of the anode-terminal flange which is on the plane of reference for longitudinal dimensions. In applications involving severe shock and vibration, the tubes may be clamped in place by applying a suitable clamping device to the anode-terminal flange. It is recommended that no other portion of the tube be subjected to clamping forces.

Connections — The terminals of each tube are in the form of concentric cylinders of graduated diameters so that they may be conveniently used with coaxial tuning devices. Spring-fingered collets should be used to make contact with the anode, grid, cathode and heater terminals. Adequate contact area and spring pressure should be provided to minimize heating and to prevent erratic circuit performance at the higher frequencies. Non-contacting or intermittently-contacting collet fingers will cause troublesome circuit behavior, especially at very-high and ultra-high frequencies. Electrode contact surfaces should be kept clean and free of oxide coatings.

Cooling — Sufficient cooling must be provided for the anode and body seals to maintain operating temperatures below the rated maximum values:

Ceramic to Metal Seals	250°C	(300°C short term overload value)
Anode Core	250°C	(300°C short term overload value)

At sea level, with an inlet air temperature of 20°C (68°F), 12.5 cubic feet per minute of air flow is required to cool the anode at 100 watts plate dissipation when the air cowling as illustrated is used. Operation at higher altitudes or with higher inlet temperatures requires increased volumes of flow to obtain equivalent cooling. When using the anode cowling as illustrated here, it is necesary to provide additional facilities for seal cooling.

It should be borne in mind that operating temperature is the sole criterion of cooling effectiveness, regardless of the coolant type, flow rate or coolant temperature. One method of measuring the surface temperatures is the use of temperature sensitive lacquer, such as "Tempilaq." This product can be obtained from the Tempil Corp., 132-34 West 22nd Street, New York 11, New York. When temperature sensitive materials are used, extremely thin applications must be used to avoid interference with the transfer of heat from the tube to the air stream, which would cause inaccurate indications.

ELECTRICAL

Heater Operation — The rated heater voltage for the 3CX100A5 is 6.0 volts, and for the 3CX100F5 26.5 volts. The working voltage should be selected from the table below. The heater voltage for each type should be maintained within plus or minus of 5% of its intended value to minimize variations in circuit performance and to obtain maximum tube life.

At frequencies above approximately 1000 megacycles, transit time effects begin to influence the cathode temperature. The amount of driving power diverted to heating the cathode by back-bombardment will depend upon the frequency, the plate current and driving power being supplied to the tube. If the conditions of operation result in appeciable cathode back-heating, it may be necessary to start dynamic tube operation at normal heater voltage followed by a reduction of heater voltage to the proper value. The following table is intended as a general guide in this respect.

Mc	3CX100A5 Ef	3CX100F5 Ef
Up to 1000 - - - - - -	6.0	26.5
1000 to 2000 - - - - -	5.5	24.3
2000 and above - - - -	5.0	22.1

The heater of the 3CX100A5 must not be operated at less than 4.5 volts in any case, nor should the heater of the 3CX100F5 be operated at less than 20.0 volts in any case.

Cathode Operation — The oxide-coated unipotential cathode in these tubes must be protected against excessively high emission currents. For all types of operation the maximum rated dc current is 125 milliamperes. The cathode and one side of the heater are connected together internally.

It is recommended that the rated heater voltage be applied for a minimum of 30 seconds before other operating voltages are applied. Tube perfomance will become stabilized 60 seconds after the heater voltage is applied.

Control Grid Operation — Grid dissipation must not exceed the rated maximum 2.0 watts grid dissipation power.

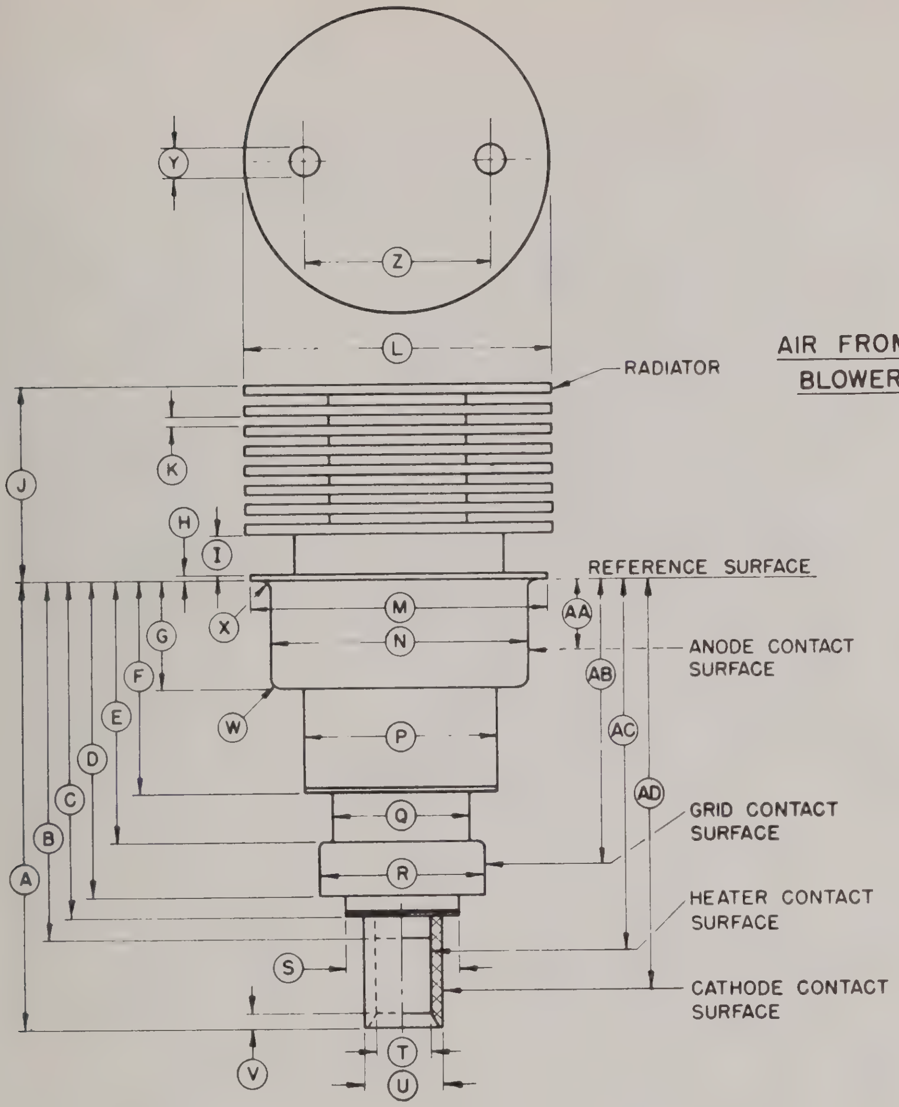
At operating frequencies near 500 megacycles, the driving power necessary for maximum output is in the order of 6 watts and as the operating frequency is increased the driving power requirements increase. Most of this increased driving power is absorbed in circuit losses other than grid dissipation, however, so that the grid dissipation will increase very little.

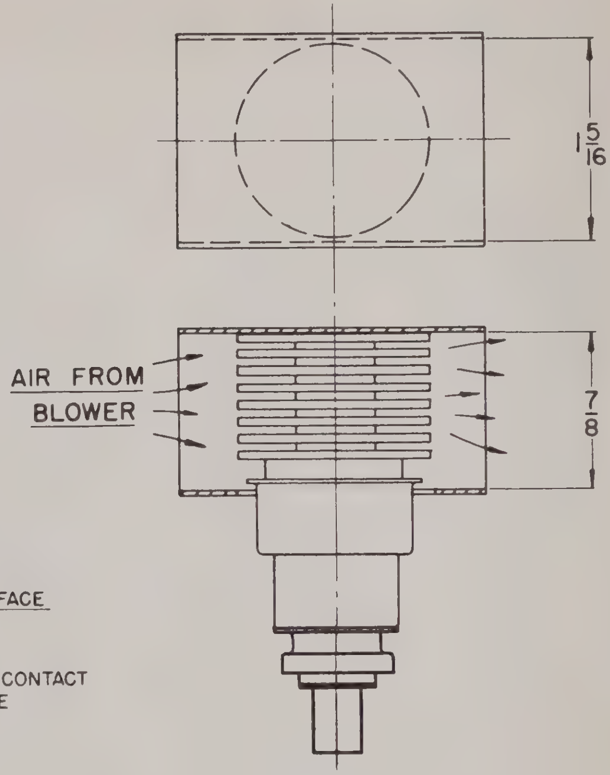
The maximum rated dc grid voltage is —150 volts and the grid may be driven to a maximum of 30 peak volts positive or to —400 peak volts negative.

The grid bias required by various individual tubes may vary between limits approximately 50% above and below the center value, and means should be provided in the equipment to accommodate such variation.

Plate Operation — The maximum rated plate dissipation power is 100 watts. In plate modulated applications, the carirer plate dissipation power must be limited to 70 watts to avoid exceeding the plate dissipation rating with 100% sine wave modulation.

Special Applications — If it is desired to operate this tube under conditions widely different from those given here, write to Power Grid Marketing, Eitel-McCullough, Inc., 301 Industrial Way, San Carlos, California for information and recommendations.





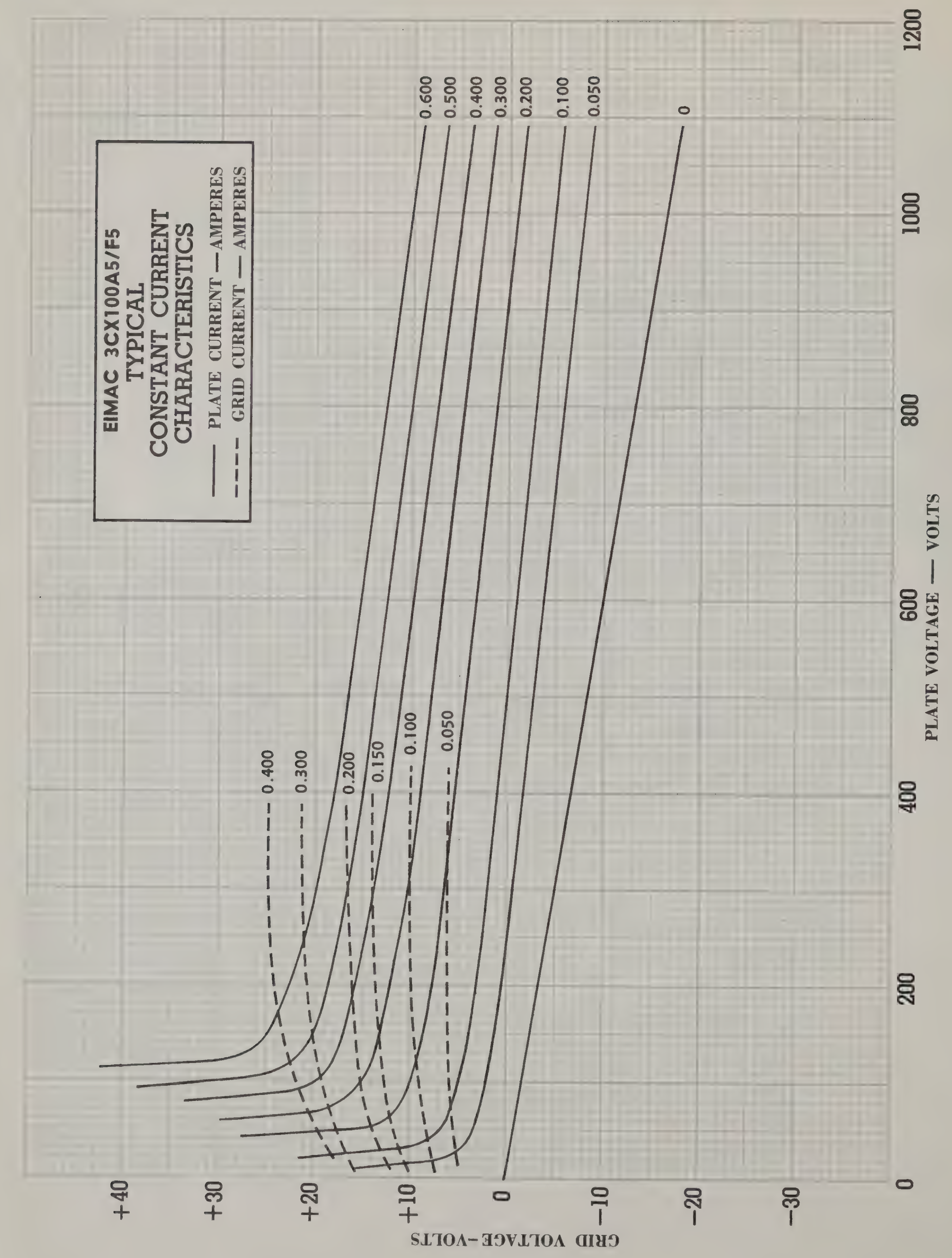
RECOMMENDED COWLING
FOR
FORCED-AIR COOLING
OF ANODE

REF.	NOM.	MIN.	MAX.
A		1.815	1.875
B			1.534
C			1.475
D		1.289	1.329
E		1.085	1.135
F		.880	.920
G		.462	.477
H			.040
I		.125	.185
J		.766	.826
K		.025	.046
L		1.234	1.264
M		1.180	1.195
N		1.025	1.035
P		.772	.792
Q		.541	.561
R		.655	.665
S			.545
T		.213	.223
U		.315	.325
V			086
W			.100
X			.035
Y		.105	.145
Z		.650	.850
AA		.035	361
AB		1.185	1.265
AC		1.534	1.728
AD		1.475	1.815

NOTES:

1. The total indicated runout of the anode contact surface and the grid contact surface with respect to the cathode contact surface shall not exceed .020.

2. The total indicated runout of the heater contact surface with respect to the cathode contact surface shall not exceed .012.

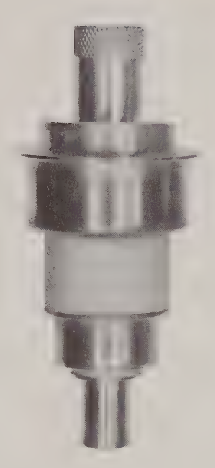

EIMAC 3CX100A5/F5
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
—— PLATE CURRENT — AMPERES
- - - GRID CURRENT — AMPERES
0.600
0.500
0.400
0.300
0.200
0.100
0.050
0
0.400
0.300
0.200
0.150
0.100
0.050
PLATE VOLTAGE — VOLTS
0
200
400
600
800
1000
1200
GRID VOLTAGE-VOLTS
+40
+30
+20
+10
0
-10
-20
-30

TECHNICAL DATA

7855
7855K

HIGH-MU PLANAR TRIODE

The EIMAC 7855 and 7855K are ruggedized high-mu planar triodes of ceramic/metal construction, designed for grid pulsed, plate pulsed and CW operation in amplifiers, oscillators and frequency multipliers from low frequency to 3 GHz. The 7855 is supplied with a radiator for forced air cooling and the 7855K without radiator for conduction and convection cooling. Except for plate dissipation ratings, the characteristics of the two tubes are the same. In addition to the low interelectrode capacitances and high transconductance these tubes exhibit special design features such as a frequency stable anode and an arc resistant cathode to assure stable operation under adverse conditions and to minimize catastrophic failure due to arc over during a circuit malfunction.


7855K

7855

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Cathode: Oxide Coated, Unipotential	
Heater: Voltage	6.0 ± 0.3 V
Current, at 6.0 volts	1.00 A
Transconductance (Average):	
$I_b = 70$ mA	25 mmhos
Amplification Factor (Average):	80
Direct Interelectrode Capacitances (Grounded Cathode)[2]	
Cin	6.8 pF
Cout	0.04 pF
Cgp	2.50 pF
Cut-off Bias[3]	-30 V max.

1. Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.
2. Capacitance values for a cold tube as measured in a special shielded fixture in accordance with Electronic Industries Association Standard RS-191.
3. Measured with one milliampere plate current and a plate voltage of 1 kVdc.

MECHANICAL

Maximum Overall Dimensions:	
Length	2.39 in; 60.60 mm
Diameter	1.27 in; 32.20 mm
Net Weight (7855)	57 gm
(7855K)	40 gm
Operating Position	Any

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Maximum Operating Temperature:	
Ceramic/Metal Seals	250°C
Anode Core	250°C
Cooling (7855)	Forced air
(7855K)	Conduction, convection
Terminals	Coaxial, special

ENVIRONMENTAL

Shock, 11 ms, non-operating	60	G
Vibration, operating, all axes 55 to 500 Hz	10	G
Altitude, max (in a suitably designed circuit)	50,000	ft.

GRID PULSED OR PLATE PULSED AMPLIFIER OR OSCILLATOR

MAXIMUM RATINGS/ABSOLUTE VALUES

DC PLATE VOLTAGE (grid pulsed)	2500	VOLTS
PEAK PULSE PLATE VOLTAGE (plate pulsed)	3500	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID CATHODE VOLTAGE		
Grid negative to cathode	-700	VOLTS
Grid positive to cathode	250	VOLTS
PULSE PLATE CURRENT	3.0	AMPERES
PULSE GRID CURRENT	1.8	AMPERES
PLATE DISSIPATION (7855)	100	WATTS
(7855K)	10	WATTS
GRID DISSIPATION	2.0	WATTS
FREQUENCY	3.0	GIGAHERTZ
PULSE DURATION[1]	6	µsec
DUTY FACTOR[1]	.0033	

TYPICAL OPERATION Grid Pulsed Oscillator, Representative Application

Plate Voltage	2000	Vdc
Grid Voltage	-75	Vdc
Heater Voltage	5.7	V
Peak Video Plate Current	1.3	a
Peak Video Grid Current	0.8	a
Useful Power Output (approx.)	750	w
Frequency	1.090	GHz
Pulse Duration	0.5	µs
Duty Factor	.001	

PULSE MODULATOR OR PULSE AMPLIFIER SERVICE

MAXIMUM RATINGS/ABSOLUTE VALUES

DC PLATE VOLTAGE	2500	VOLTS
PEAK PLATE VOLTAGE	3500	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
Grid negative to cathode	-750	VOLTS
Grid positive to cathode	150	VOLTS
PULSE CATHODE CURRENT	4.8	AMPERES
DC PLATE CURRENT	100	MILLIAMPERES
PLATE DISSIPATION (7855)	100	WATTS
(7855K)	10	WATTS
GRID DISSIPATION	1.5	WATTS
PULSE DURATION[1]	6	µs
DUTY FACTOR[1]	.0033	
CUT-OFF MU	60	

1. For application requiring longer pulse duration and/or higher duty cycle consult the nearest Varian Electron Tube and Device Field Office, or the Product Manager Eimac-Division of Varian, Salt Lake City, Utah.

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.	
Heater: Current at 6.0 volts	0.90	1.05	A
Cathode Heating Time	60	---	sec.
Interelectrode Capacitances [1](grounded cathode connection)			
Cin	6.00	7.50	pF
Cout	---	0.04	pF
Cgp	2.35	2.65	pF

1. Capacitance values for a cold tube as measured in a special shielded fixture. When the cathode is heated to the proper temperature, the grid-cathode capacitance will increase from the cold value by approximately 1 pF due to thermal expansion of the cathode.

APPLICATION

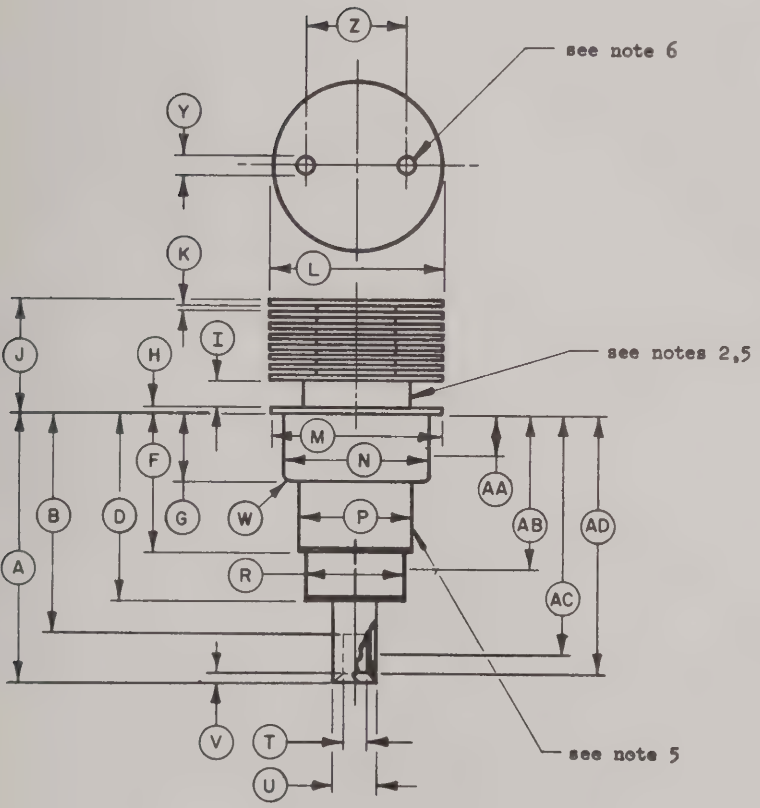
For operating information refer to EIMAC bulletin #15, "Operating Instruction for Planar Triodes."

ELECTRODE CONTACT DIMS. (see note 7)

Dim. in Inches		Dim.	Dim. in Millim.	
Min.	Max.		Min.	Max.
.035	.361	AA	.89	9.17
1.021	1.101	AB	25.93	27.97
1.219	1.413	AC	30.96	35.89
1.160	1.500	AD	29.46	38.10

DIMENSIONAL DATA

Dim. in Inches			Dim. in Millimeters		
Min.	Max.	Dim.	MIN.	MAX.	
1.500	1.560	A	38.10	39.62	
	1.214	B		30.84	
1.125	1.165	D	28.58	29.59	
.800	.840	F	20.32	21.34	
.462	.477	G	11.73	12.12	
	.040	H		1.02	
.125	.185	I	3.18	4.70	
.766	.826	J	19.46	20.98	
.025	.046	K	.64	1.17	
1.234	1.264	L	31.34	32.11	
1.180	1.195	M	29.97	30.35	
1.025	1.035	N	26.04	26.29	
.752	.792	P	19.10	20.12	
.655	.665	R	16.64	16.89	
.213	.223	T	5.41	5.66	
.315	.325	U	8.00	8.26	
	.086	V		2.18	
	.100	W		2.54	
.105	.145	Y	2.67	3.68	
.650	.850	Z	16.51	21.59	



7855

NOTES:

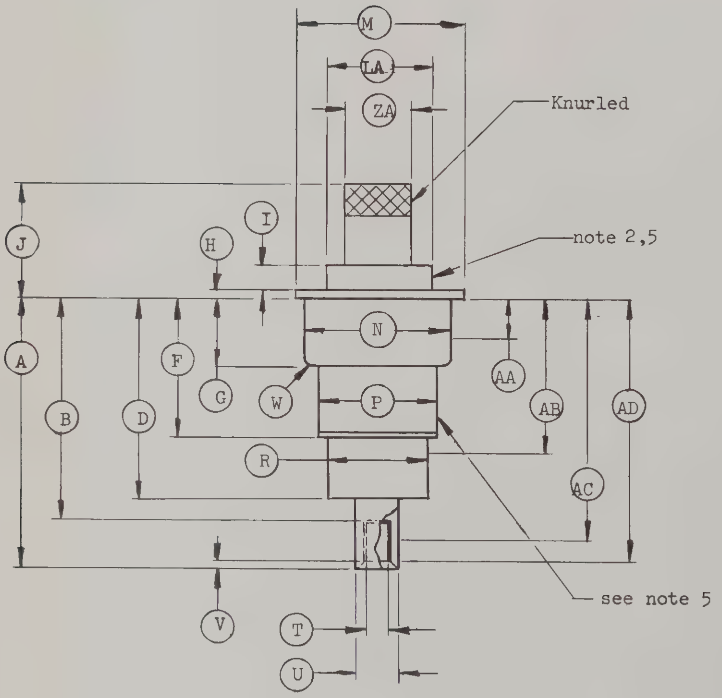
1. Metric equivalents, to the nearest .01 mm, are given for general information only & are based on 1 inch = 25.4 mm.
2. This surface to be used to measure anode shank temperature.
3. Eccentricity of contact surfaces shall be gaged from center line of reference & shall be as follows:

Contact Surface	TIR Max.	Reference
Anode	.020	Cathode
Grid	.020	Cathode
Heater	.012	Cathode

4. Dias. N,R,T & U shall apply throughout entire lenght as defined by dims. AA,AB,AC,AD respectively.
5. This surface shall not be used for clamping or locating.
6. Holes for extractor thru top fin only.
7. Electrode Contact dims. are for socket design purposes & are not intended for inspection purposes.

ELECTRODE CONTACT AREA (see note 6)				
Dim. in Millimeters		Dim.	Dim. in Inches	
Min.	Max.		Min.	Max.
.89	9.17	AA	.035	.361
25.93	27.97	AB	1.021	1.101
30.96	35.89	AC	1.219	1.413
29.46	38.10	AD	1.160	1.500

DIMENSIONAL DATA				
Dim. in Inches			Dim. in Millimetres	
Min.	Max.	Dim.	MIN.	MAX.
1.500	1.560	A	38.10	39.62
	1.215	B		30.84
1.125	1.165	D	28.58	29.59
.800	.840	F	20.32	21.34
.462	.477	G	11.73	12.12
	.040	H		1.02
	.185	I		4.70
.766	.826	J	19.46	20.98
.025	.046	K	.64	1.17
1.234	1.264	L	31.34	32.11
1.180	1.195	M	29.97	30.35
1.025	1.035	N	26.04	26.29
.752	.792	P	19.10	20.12
.655	.665	R	16.64	16.89
.213	.223	T	5.41	5.66
.315	.325	U	8.00	8.26
	.086	V		2.18
	.100	W		2.54
.840	.860	LA	21.34	21.84
.427	.447	ZA	10.85	11.35



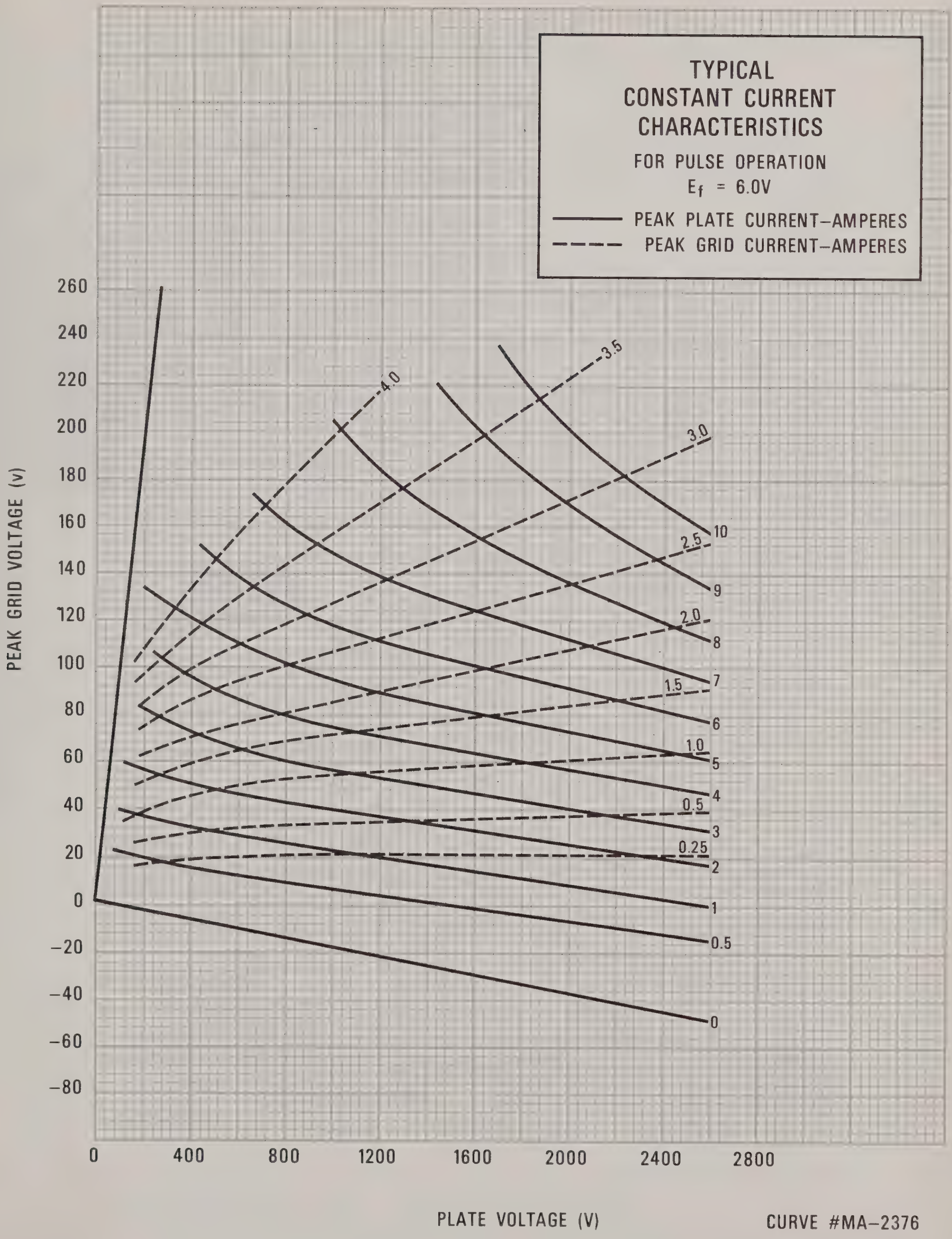
7855K

NOTES:

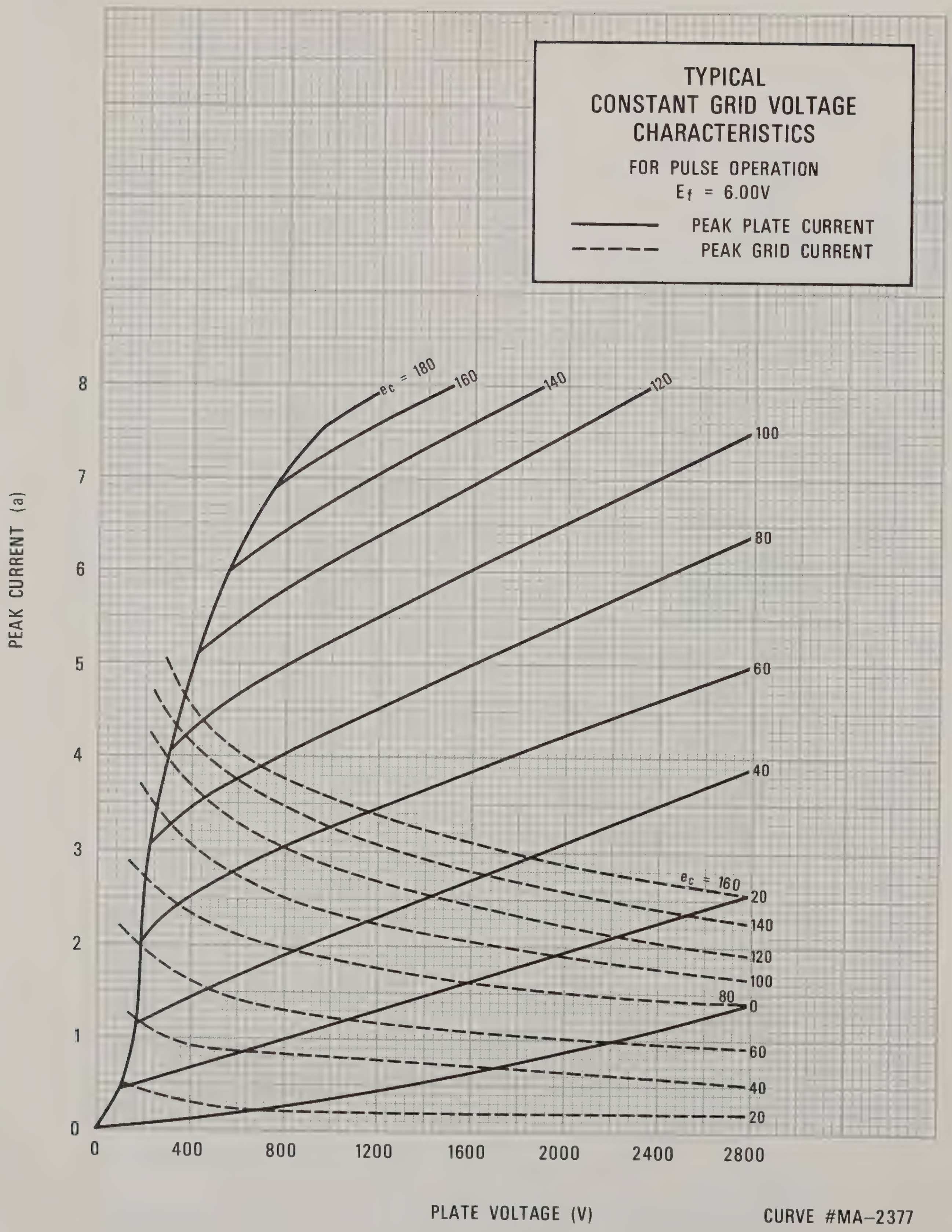
1. Metric equivalents to the nearest .01mm, are given for general information only & are based on 1 inch= 25.4 mm.
2. This surface shall be used to measure Anode shank temperature.
3. Eccentricity of contact surfaces shall be gaged from center line of reference & shall be as follows:

Contact Surface	TIR Max.	Reference
Anode	.020	Cathode
Grid	.020	Cathode
Heater	.012	Cathode

4. Dias. N,R,T,U shall apply throughout entire lenght as defined by dims. AA,AB,AC,AD respectively.
5. This surface shall not be used for clamping or locating.
6. Electrode Contact Dims. are intended for socket design only & are not intended for inspection purposes.



CURVE #MA–2376


TYPICAL
CONSTANT GRID VOLTAGE
CHARACTERISTICS
FOR PULSE OPERATION
E_f = 6.00V
PEAK PLATE CURRENT
PEAK GRID CURRENT
e_c = 180
160
140
120
100
80
60
40
20
0
e_c = 160
20
140
120
100
80
0
60
40
20
PEAK CURRENT (a)
0
1
2
3
4
5
6
7
8
0
400
800
1200
1600
2000
2400
2800
PLATE VOLTAGE (V)
CURVE #MA–2377

Eimac®

EITEL-McCULLOUGH, INC.
SAN CARLOS, CALIFORNIA

TENTATIVE DATA

8283
3CX1000A7

HIGH-MU POWER TRIODE

The 8283/3CX1000A7 is a ceramic-metal zero-bias triode intended for Class-B linear amplifier service in either grid-driven or cathode-driven configuration. It is recommended for use as a grid driven, push-pull audio amplifier or modulator and as a cathode driven linear amplifier through the VHF-TV bands.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated-Tungsten Mesh	Min.	Nom.	Max.	
Voltage		5.0		volts
Current	28		33	amperes
Amplification Factor		200		
Direct Interelectrode Capacitance, Grounded Cathode (average)				
Input	29		35	uuf
Output			0.2	uuf
Feedback	12		16	uuf
Frequency for Maximum Ratings			220	Mc

MECHANICAL

Base	Special Breechblock
Recommended Socket	Eimac SK-860 or SK-870
Recommended Chimney	Eimac SK-816
Operating Position	Vertical, base up or down
Cooling	Forced air
Maximum Temperature: Anode Core and Ceramic-Metal Seals	250°C
Maximum Dimensions: Height	4.8 inches
Maximum Dimensions: Diameter	3.38 inches
Net Weight	2 pounds

RADIO-FREQUENCY LINEAR AMPLIFIER
Class-B, Grounded Grid

MAXIMUM RATINGS

DC PLATE VOLTAGE*	3000 MAX.	VOLTS
DC PLATE CURRENT	1.0 MAX.	AMPS
PLATE DISSIPATION	1000 MAX.	WATTS
GRID DISSIPATION	45 MAX.	WATTS

* See "Zero-Bias Operation"

TYPICAL OPERATION, (single-tone conditions)

DC Plate Voltage	2000	2500	volts
DC Grid Voltage	0	0	volts
Zero-Signal DC Plate Current	200	310	mA
Max-Signal DC Plate Current	875	800	mA
Max-Signal DC Grid Current	590	320	mA
Peak RF Driving Voltage	80	73	volts
Driving Power	78	67	watts
Max-Signal Plate Output Power	1000	1200	watts
Resonant Load Impedance	1100	1670	ohms
RF Driving Impedance	41	42	ohms

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AUDIO-FREQUENCY AMPLIFIER OR MODULATOR

Class-B, Grid Driven

MAXIMUM RATINGS

DC PLATE VOLTAGE*	3000 MAX.	VOLTS
DC PLATE CURRENT	1.0 MAX.	AMPS
PLATE DISSIPATION	1000 MAX.	WATTS
GRID DISSIPATION	45 MAX.	WATTS

* See "Zero-Bias Operation"

TYPICAL OPERATION, (two tubes)

DC Plate Voltage	2000	2500	volts
DC Grid Voltage	0	0	volts
Zero-Signal DC Plate Current	400	500	mA
Max-Signal DC Plate Current	2.0	2.0	amps
Max-Signal DC Grid Current	590	480	mA
Peak AF driving Voltage (per tube)	95	90	volts
Driving Power	25	44	watts
Load Resistance (plate-to-plate)	1900	2580	ohms
Max-Signal Plate Output Power	2350	3100	watts

RADIO-FREQUENCY AMPLIFIER OR OSCILLATOR - Class C.

MAXIMUM RATINGS

DC PLATE VOLTAGE*	3000 MAX.	VOLTS
DC GRID VOLTAGE	-100 MAX.	VOLTS
DC PLATE CURRENT	0.7 MAX.	AMPS
PLATE DISSIPATION	1000 MAX.	WATTS
GRID DISSIPATION	45 MAX.	WATTS

* See "Zero-Bias Operation"

PLATE MODULATED RADIO-FREQUENCY AMPLIFIER - Class C.

MAXIMUM RATINGS

DC PLATE VOLTAGE	2000 MAX.	VOLTS
DC GRID VOLTAGE	-100 MAX.	VOLTS
DC PLATE CURRENT	0.55 MAX.	AMPS
PLATE DISSIPATION	670 MAX.	WATTS
GRID DISSIPATION	45 MAX.	WATTS

APPLICATION

MECHANICAL

Mounting: The 3CX1000A7 must be operated with its axis vertical. Its base may be down or up.

Socket: The Eimac SK-860 and SK-870 sockets are available for use with the 3CX1000A7. The SK-860 has its grid contacts grounded to the socket frame. Eimac SK-816 chimney directs cooling air from the socket through the cooling fins.

Cooling: The maximum temperature rating for the external surfaces and the anode-core is 250° C. Tube life is prolonged if these areas are maintained at lower temperatures. The table below lists air-flow rates to maintain tube temperature below 225°C with 50° C inlet air and base-to-anode air-flow. At frequencies above 30 Mc or at greater altitude, these quantities should be increased.

Plate Dissipation (watts)	SEA LEVEL		10,000 FEET	
	Air-flow (CFM)	Pressure Drop (inches of water)	Air-flow (CFM)	Pressure Drop (inches of water)
600	18	0.1	26.5	0.15
800	26.5	0.2	39	0.3
1000	37	0.4	54	0.6

*Since power dissipated by the filament represents about 170 watts and grid dissipation can reach 45 watts, an additional 215 watts has been included in preparing this tabulation.

ELECTRICAL

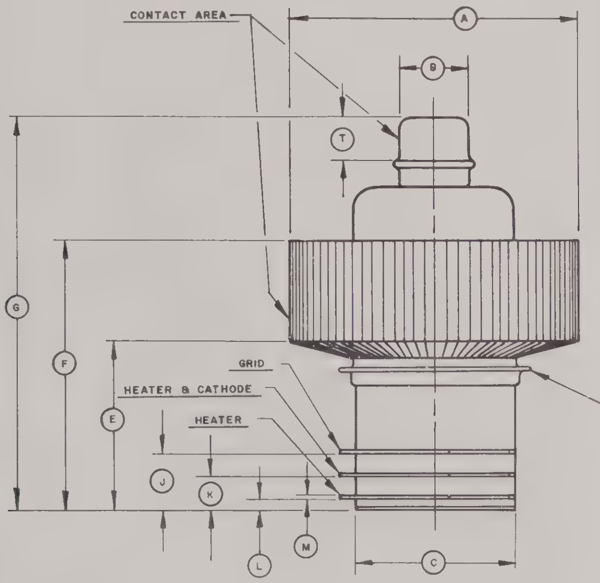
Filament: Rated filament voltage for the 3CX1000A7 is 5.0 volts. Filament voltage, as measured at the socket, should be maintained at this value to obtain optimum performance and maximum tube life. In no case should it be allowed to deviate from 5.0 volts by more than plus or minus five percent.

Input Circuit: When the 3CX1000A7 is operated as a grounded-grid rf amplifier, the use of a resonant tank in the cathode circuit is recommended to obtain greatest linearity and power output. For best results with a single-ended amplifier, it is suggested that the cathode tank circuit operate at a "Q" of five or more.

Class C Operation: Although designed for Class B service, the 3CX1000A7 may be operated as a Class-C power amplifier or oscillator, or as a plate-modulated rf amplifier. The zero-bias characteristic can be used to advantage in Class C amplifiers by employing only grid leak bias. If driving power fails, plate dissipation is kept to a low level since the tube will operate at normal, static zero-bias conditions.

Zero-Bias Operation: Operating at zero-bias is not recommended with plate voltages over 2500 volts since plate dissipation may be exceeded. Similarly, the safety of zero-bias operation as mentioned above under "Class-C Operation" is not available at plate voltages above 2500 volts. Straight Class-C or Class-B operation is, of course, permissible up to 3000 volts where other ratings are not exceeded.

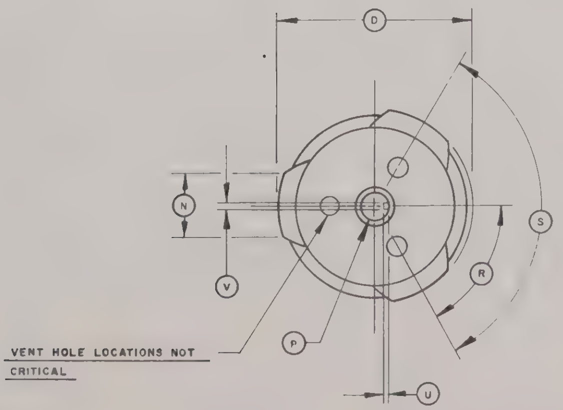
Special Applications: If it is desired to operate this tube under conditions widely different from those listed here, write to Power Grid Tube Marketing, Eitel-McCullough, Inc., San Carlos, California for information and recommendations.



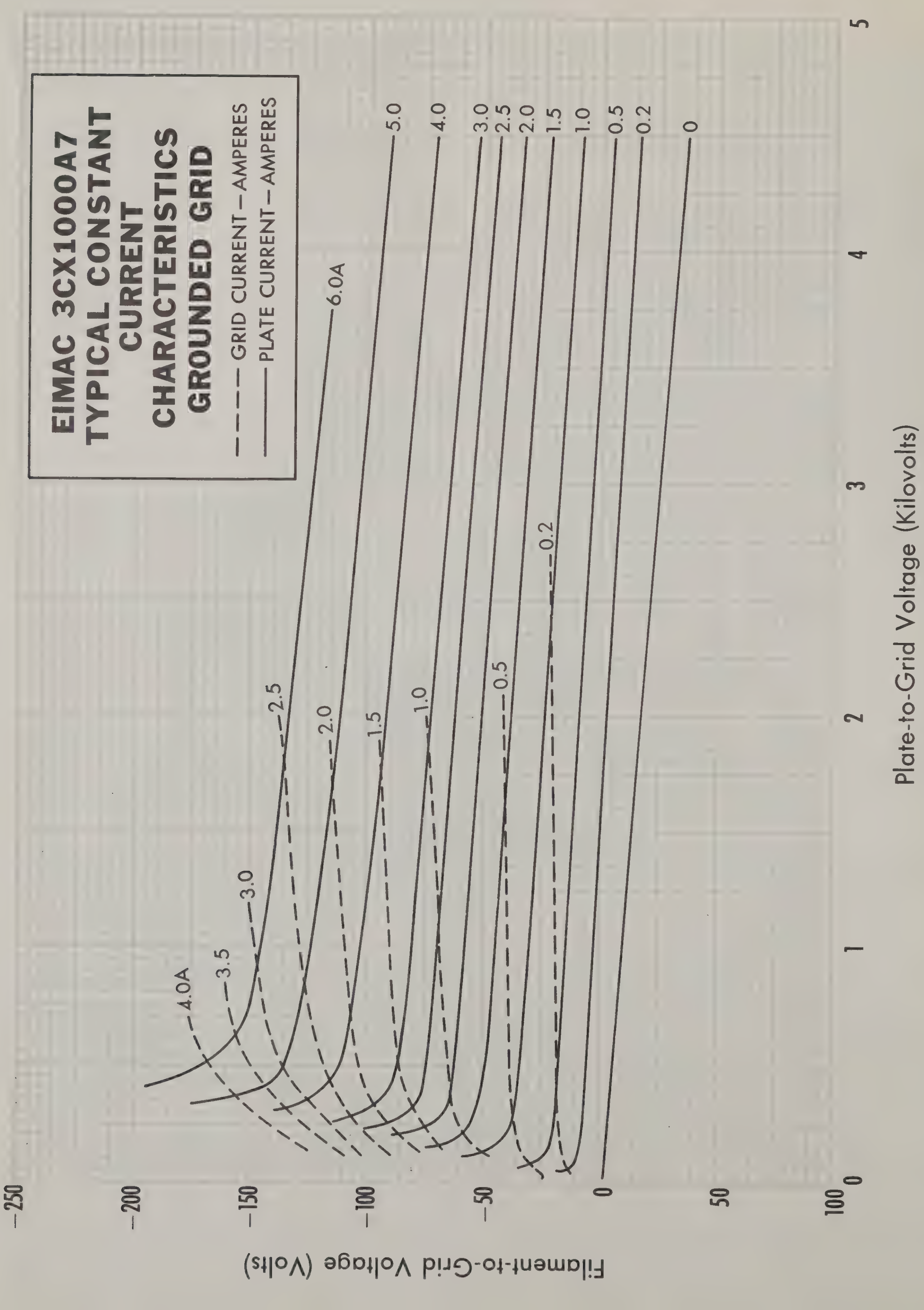
DO NOT CONTACT THIS AREA

DIMENSIONS IN INCHES

DIMENSIONAL DATA			
REF.	MIN	MAX	NOM
A	3.325	3.375	
B	.807	.817	
C	1.870	1.900	
D	2.250 DIA.	2.300 DIA.	
E	1.920	2.105	
F	3.135	3.275	
G	4.600	4.800	
J	.675	.725	
K	.400	.450	
L	.140	.170	
M	.020	.030	
N	.700	.800	
P	.314 DIA.	.316 DIA.	
R	55°	65°	
S	115°	125°	
T	.470	.530	
U	.023	.043	
V	.057 DIA.	.073 DIA.	



NOTE: These dimensions reflect standard manufacturing tolerances. Where they are to be made the basis of purchase specifications, they should first be checked with the factory.



EIMAC 3CX1000A7 TYPICAL CONSTANT CURRENT CHARACTERISTICS GROUNDED GRID

TECHNICAL DATA

8877
3CX1500A7

HIGH-MU POWER TRIODE

The EIMAC 8877/3CX1500A7 is a rugged ceramic/metal power triode designed for use as a cathode driven Class AB_2 amplifier in audio or radio frequency applications. The tube is recommended for linear amplifier service since high power gain may be obtained without sacrifice of low intermodulation distortion characteristics.

Low grid interception and high amplification factor combine to make the 8877/3CX1500A7 drive requirements exceptionally low for a tube of this power capacity.

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Cathode: Oxide Coated, Unipotential	
Heater: Voltage	5.0 ± 0.25 V
Current, at 5.0 volts	10 A
Transconductance (Average):	
$I_b = 1.0$ Adc	55,000 μmhos
Amplification Factor (Average)	200
Direct Interelectrode Capacitance (grounded cathode)[2]	
Cin	42 pF
Cout	0.1 pF
Cgp	10 pF
Direct Interelectrode Capacitance (grounded grid)[2]	
Cin	42 pF
Cout	10 pF
Cpk	0.1 pF
Frequency of Maximum Rating:	
CW	250 MHz

---

1. Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.

2. Capacitance values are for a cold tube as measured in a special shielded fixture in accordance with Electronic Industries Association Standard RS-191.

(Revised 5-15-71) © 1970, 1971 by Varian

Printed in U.S.A.

MECHANICAL

Maximum Overall Dimensions:	
Length	3.51 in; 89.15 mm
Diameter	3.38 in; 85.85 mm
Net Weight	25.0 oz; 708.8 gm
Operating Position	Any
Maximum Operating Temperature:	
Ceramic/Metal Seals, Anode Core	250°C
Cooling	Forced Air
Base	Special 7-pin
Recommended Air System Socket	
(Grounded Grid)	SK-2210
(Grounded Cathode)	SK-2200
Recommended Air Chimney	
(Fiberglass)	SK-2206
(Teflon)	SK-2216

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.	
Heater: Current at 5.0 volts	9.5	10.5	A
Cathode Warmup Time	90	---	sec

RADIO FREQUENCY LINEAR AMPLIFIER CATHODE DRIVEN Class AB2

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE	4000	VOLTS
DC PLATE CURRENT	1.0	AMPERE
PLATE DISSIPATION	1500	WATTS
GRID DISSIPATION	25	WATTS

TYPICAL OPERATION (Frequencies to 30 MHz)
Class AB2 Cathode Driven, Peak Envelope or
Modulation Crest Conditions

Plate Voltage	2700	3500	Vdc
Grid Voltage [1]	-8.2	-8.2	Vdc
Zero-Signal Plate Current	92	182	mAdc
Single-Tone Plate Current	740	1000	mAdc
Two-Tone Plate Current	480	675	mAdc
Single-Tone Grid Current [3]	40	74	mAdc
Two-Tone Grid Current [3]	16	25	mAdc
Peak rf Cathode Voltage [3]	68	81	v
Peak Driving Power [3]	40	64	w
Single-Tone Useful Output Power	1085	2075	W
Resonant Load Impedance	1820	2000	Ω
Intermodulation Distortion Products [2]			
3rd Order	-40	-38	db
5th Order	-41	-41	db

1. Positive cathode bias provided by zener diode.
2. The intermodulation distortion products are referenced against one tone of a two equal tone signal.
3. Approximate values.

TYPICAL OPERATION (220 MHz)
Class AB2 Cathode Driven

Plate Voltage	2500	Vdc
Grid Voltage [1]	-8.2	Vdc
Plate Current	1000	mAdc
Grid Current	10	mAdc
Useful Output Power	1520	W
Driving Power [2]	57	W
Power Gain	14	db

1. Positive cathode bias provided by zener diode.
2. Approximate value.

APPLICATION

MECHANICAL

MOUNTING - The 8877/3CX1500A7 may be mounted in any position.

SOCKET - The grid of the 8877/3CX1500A7 terminates in the cylindrical grid ring about the base of the tube. This may be contacted by multiple clips or flexible finger stock. Connections to the heater and cathode are made via the 7-pin base.

COOLING - The maximum temperature limit for external tube surfaces and the anode core is 250°C. Tube life is prolonged if these areas are maintained at lower temperatures. For full 1500 watt anode dissipation 38.0 cfm of air is required at a back pressure of 0.60 inches to hold tube temperature below 225°C with 50°C ambient temperature at sea level. At frequencies higher than 30 MHz, or at high altitudes, the air quantity must be increased.

Base-to-Anode Air Flow (sea level)		
Anode Dissipation (watts)	Air Flow (CFM)	Pressure Drop In./H_2O
500	7.7	0.10
1000	20.3	0.23
1500	38.0	0.60

Base-to-Anode Air Flow (10,000 ft.)		
Anode Dissipation (watts)	Air Flow (CFM)	Pressure Drop In./H_2O
500	11.2	0.15
1000	29.5	0.34
1500	55.5	0.88

Note: 1) Tube mounted in SK-2200 Socket with SK-2216 Chimney.
2) An allowance of 25 watts has been made for grid dissipation and 50 watts for filament power .

ELECTRICAL

FILAMENT OPERATION - Rated filament voltage for the 8877/3CX1500A7 is 5.0 volts. Filament voltage, as measured at the socket should be maintained at this value to obtain optimum performance and maximum tube life. In no case should it be allowed to deviate from 5.0 volts by more than plus or minus five per cent.

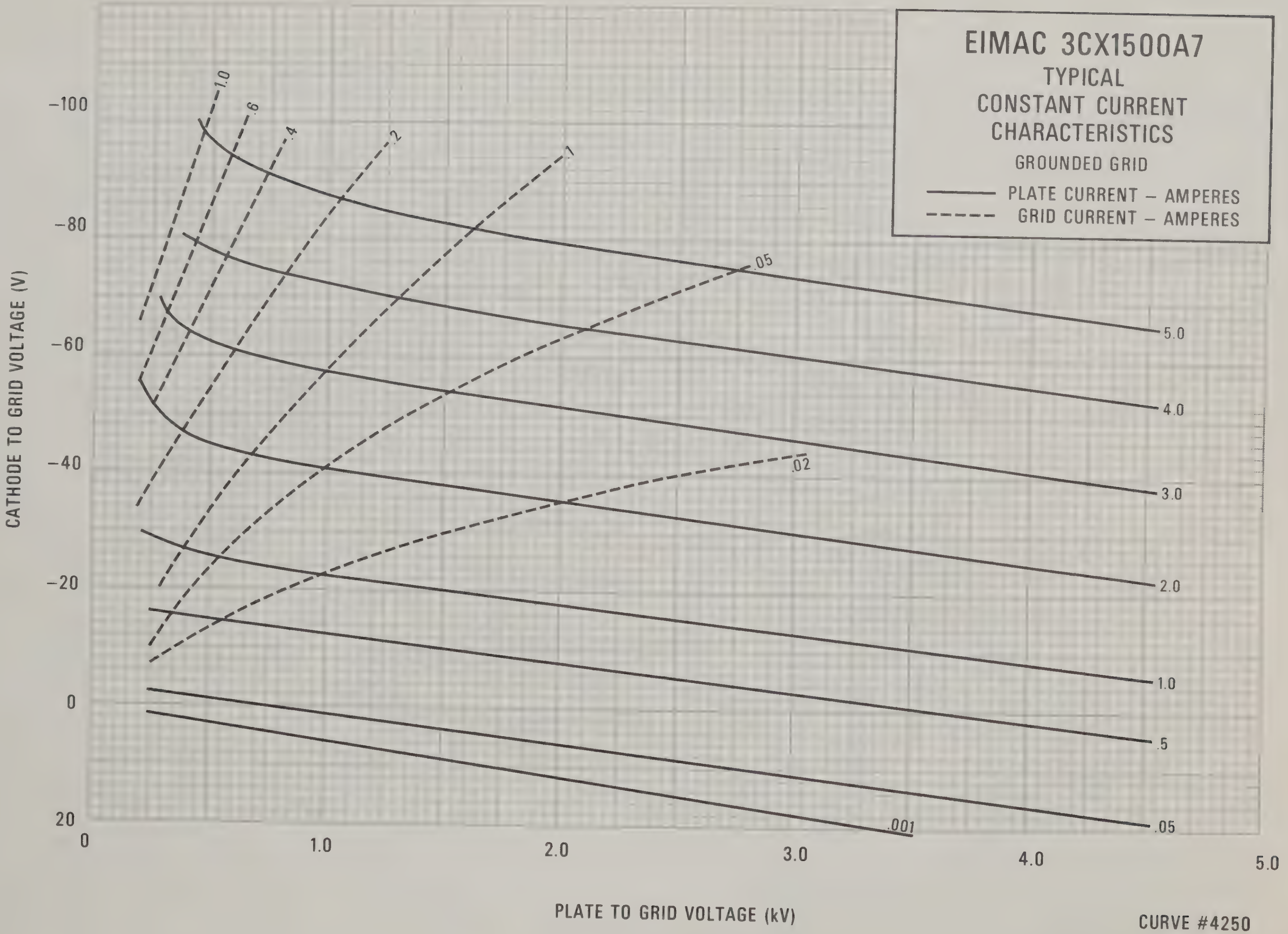
INPUT CIRCUIT - When the 8877/3CX1500A7 is operated as a cathode driven rf amplifier, the use of a resonant circuit in the cathode is recommended. For best results with a single-ended amplifier it is suggested that the cathode tank circuit operate at a Q of two or more.

CLASS C OPERATION - Although designed for Class AB_2 service, the 8877/3CX1500A7 may be operated as a Class C power amplifier or oscillator or as a plate modulated rf amplifier. The zero-bias characteristic can be used to advantage in Class C amplifiers by employing only grid resistor bias. If driving power fails, plate dissipation will be held to a safe level since the tube will operate within all ratings with zero-bias up to a plate potential of 3000 volts.

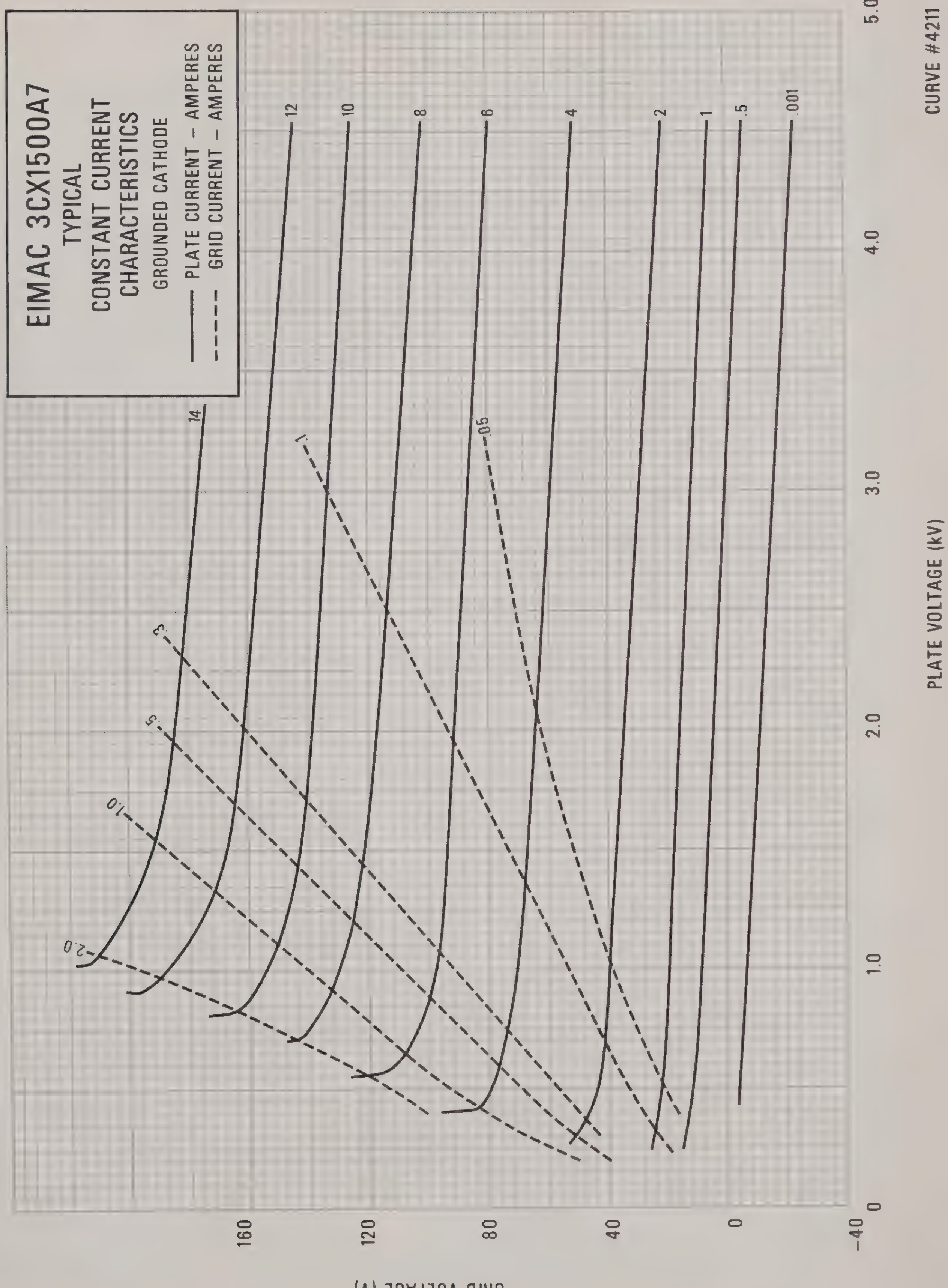
ZERO-BIAS OPERATION - Operation at zero-bias is not recommended with plate potentials over 3000 volts, since plate dissipation may be exceeded. Higher plate voltage may be used with the proper protective bias.

HIGH VOLTAGE - The 3CX1500A7 operates at voltages which can be deadly, and the equipment must be designed properly and operating precautions must be followed. Equipment must be designed so that no one can come in contact with high voltages. All equipment must include safety enclosures for high-voltage circuits and terminals, with interlock switches to open the primary circuits of the power supplies and to discharge high voltage condensers whenever access doors are opened. Interlock switches must not be bypassed or "cheated" to allow operation with access doors open. Always remember that HIGH VOLTAGE CAN KILL.

SPECIAL APPLICATIONS - If it is desired to operate this tube under conditions widely different from those given here, write to Power Grid Tube Division, EIMAC, Division of Varian, 301 Industrial Way, San Carlos, California 94070 for information and recommendations.

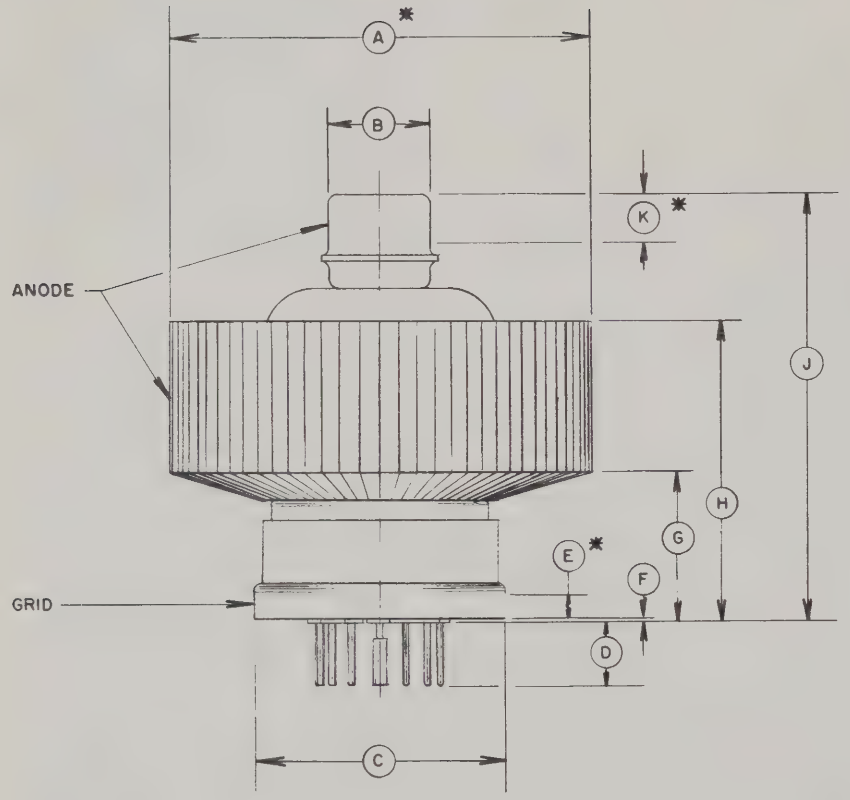

EIMAC 3CX1500A7
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
GROUNDED GRID
PLATE CURRENT – AMPERES
GRID CURRENT – AMPERES
CATHODE TO GRID VOLTAGE (V)
-100
-80
-60
-40
-20
0
20
PLATE TO GRID VOLTAGE (kV)
0
1.0
2.0
3.0
4.0
5.0
5.0
4.0
3.0
2.0
1.0
.5
.05
.001
1.0
.6
.4
.2
.1
.05
.02

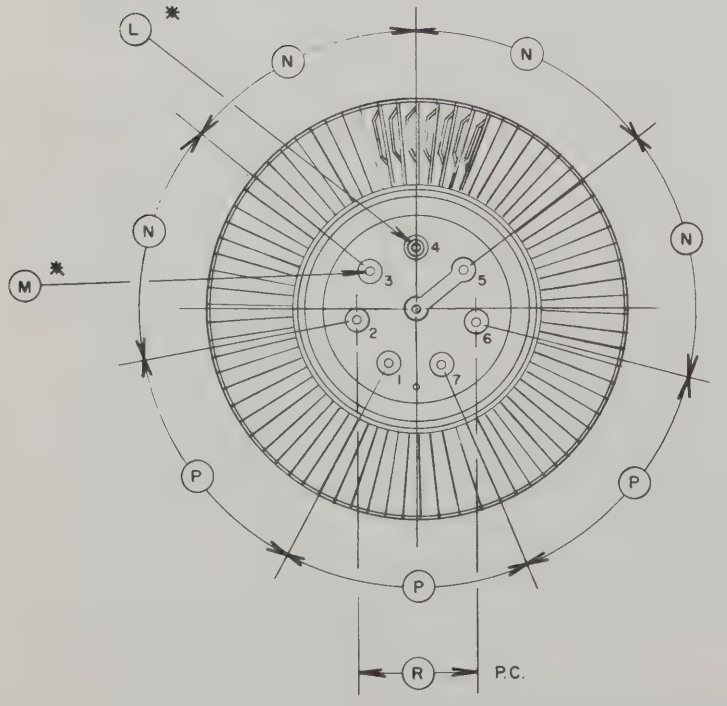
CURVE #4250


EIMAC 3CX1500A7
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
GROUNDED CATHODE
PLATE CURRENT – AMPERES
GRID CURRENT – AMPERES
14
12
10
8
6
4
2
1
.5
.001
.1
.05
.3
.5
1.0
2.0
160
120
80
40
0
–40
GRID VOLTAGE (V)
0
1.0
2.0
3.0
4.0
5.0
PLATE VOLTAGE (kV)
CURVE #4211

DIMENSIONAL DATA						
DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	3.350	3.380	— —	85.09	85.85	— —
B	0.810	0.820	— —	20.57	20.83	— —
C	1.995	2.015	— —	50.67	51.18	— —
D	0.438	0.562	— —	11.13	14.27	— —
E	0.235	— —	— —	5.97	— —	— —
F	0.000	0.040	— —	0.00	1.02	— —
G	1.100	1.225	— —	27.94	31.12	— —
H	2.300	2.425	— —	58.42	61.60	— —
J	3.370	3.510	— —	85.60	89.15	— —
K	0.470	0.530	— —	11.94	13.46	— —
L	0.120	0.127	— —	3.05	3.23	— —
M	0.056	0.062	— —	1.42	1.57	— —
N	— —	— —	51°	— —	— —	51°
P	— —	— —	52°	— —	— —	52°
R	— —	— —	1.000	— —	— —	25.40

NOTES:
1. REF. DIMENSIONS ARE FOR INFO. ONLY & ARE NOT REQUIRED FOR INSPECTION PURPOSES.





PIN CONNECTIONS

1 - HEATER
5 - HEATER
2-3-4-6-7 CATHODE

TECHNICAL DATA

3CX2500H3

MEDIUM-MU
AIR-COOLED
POWER TRIODE

The EIMAC 3CX2500H3 is a ceramic/metal, forced air cooled, external anode power triode designed primarily for use in industrial radio-frequency heating services. Its anode is conservatively rated at 2.5 kilowatts of plate dissipation with low air flow and pressure drop.

Input of 12.5 kilowatts is permissable up to 75 megahertz. Plentiful reserve emission is available from its 390 watt filament. The grid structure is rated at 150 watts making this tube an excellent choice for severe applications.

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Filament: Thoriated Tungsten	
Voltage	7.5 ± 0.37 V
Current, at 7.5 volts	50 A
Amplification Factor (Average)	20
Direct Interelectrode Capacitance (grounded cathode)[2]	
Input	35.0 pF
Output	0.9 pF
Feedback	20.0 pF
Frequency of Maximum Rating:	
CW	75 MHz

1. Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.
2. Capacitance values are for a cold tube as measured in a special shielded fixture.

MECHANICAL

Maximum Overall Dimensions:	
Length (excluding leads)	9.000 in; 228.60 mm
Diameter	4.250 in; 107.95 mm
Net Weight	6.5 lb; 14.3 kg
Operating Position	Vertical, base up or down
Maximum Operating Temperature:	
Ceramic/Metal Seals	250°C
Cooling	Forced Air
Base	See Outline

(Effective 2-1-71) © by Varian

Printed in U.S.A.

RADIO FREQUENCY INDUSTRIAL OSCILLATOR
Class C (Filtered DC Power Supply)

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE	6000	VOLTS
DC GRID VOLTAGE	-1000	VOLTS
DC PLATE CURRENT	2.5	AMPERES
PLATE DISSIPATION	2500	WATTS
PLATE INPUT POWER	12.5	kW
DC GRID CURRENT	0.4	AMPERE

TYPICAL OPERATION (Frequencies to 75 MHz)[2]

Plate Voltage	4000	6000	Vdc
Grid Voltage	-300	-500	Vdc
Plate Current	2.50	2.08	Adc
Grid Current[1]	0.245	0.180	mAdc
Peak rf Grid Voltage[1]	280	265	v
Calculated Driving Power[1]	142	136	W
Plate Input Power	10.0	12.5	kW
Plate Dissipation	2.5	2.5	W
Plate Output Power	7.5	10.0	W
Resonant Load Impedance	910	1625	Ω

1. Approximate value.
2. Loaded Conditions

NOTE: TYPICAL OPERATION data are obtained from direct measurement or by calculation from published characteristic curves. Adjustment of the rf grid voltage to obtain the specified plate current at the specified bias, screen and plate voltages is assumed. If this procedure is followed, there will be little variation in output power when the tube is changed, even though there may be some variation in grid and screen current. The grid and screen currents which result when the desired plate current is obtained are incidental and vary from tube to tube. These current variations cause no difficulty so long as the circuit maintains the correct voltage in the presence of the variations in current. In the case of Class C Service, if grid bias is obtained principally by means of a grid resistor, the resistor must be adjustable to obtain the required bias voltage when the correct rf grid voltage is applied.

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.	
Filament: Current at 7.5 volts	48	53	A
Interelectrode Capacitance[1] (grounded filament connection)			
Input	29.2	40.2	pF
Output	0.6	1.2	pF
Feedback	16.8	23.2	pF

1. Capacitance values are for a cold tube as measured in a shielded fixture.

APPLICATION

MECHANICAL

MOUNTING - The 3CX2500H3 must be mounted vertically either base up or down. A mounting flange is provided on the grid terminal to allow bolting the tube to a grid deck or a strap. Filament voltage is applied through two heavy flexible leads.

COOLING - Forced-air cooling must be provided to hold the ceramic/metal seals and anode core temperature below the maximum rating of 250°C. At ambient temperatures above 50°C, at higher altitudes and at operating temperatures above 30 MHz, additional air flow must be provided. Sea level and 5000 foot altitude air flow requirements to maintain seal temperatures below 200°C in 50°C ambient air are tabulated below (for operation below 30 MHz).

Anode-to-Base Air Flow				
	Sea Level		5000 Feet	
Anode Dissipation watts	Air Flow CFM	Pressure Drop Inches Water	Air Flow CFM	Pressure Drop Inches Water
1500	33	0.6	40	0.74
2500	66	1.25	79	1.49

Base-to-Anode Air Flow				
	Sea Level		5000 Feet	
Anode Dissipation watts	Air Flow CFM	Pressure Drop Inches Water	Air Flow CFM	Pressure Drop Inches Water
1500	32	0.6	39	0.74
2500	57	1.0	68	1.23

*Since the power dissipated by the filament represents about 400 watts and since grid dissipation can, under some conditions represent another 150 watts, allowance has been made in preparing this tabulation for an additional 500 watts.

Additional stem cooling air must be provided. 14 CFM of air directed against the center rod ½'' below the outer filament contact ring by a 1½'' I.D. air duct arranged at a 45° angle with the center line of the tube will provide adequate cooling.

ELECTRICAL

FILAMENT - The rated filament voltage for the 3CX2500H3 is 7.5 volts. Filament voltage, as measured at the tube, must be maintained at 7.5 volts plus or minus five percent for maximum tube life and consistent performance.

GRID OPERATION - The grid current rating is 0.4 ampere dc. This value should not be exceeded for more than very short periods such as during tuning. Over-current protection in the grid circuit should be provided. Ordinarily it will not be necessary to operate with more than 0.275 ampere grid current to obtain reasonable efficiency. In industrial heating service with varying loads, grid current should be monitored continuously with a dc current meter. The maximum grid dissipation rating is 150 watts.

PLATE OPERATION - Maximum plate voltage rating of 6000 volts and maximum plate current of 2.5 amperes dc should not be applied simultaneously as rated plate dissipation may be exceeded. The 12.5 kilowatts input rating applies for Class C amplifier or oscillator service with no modulation.

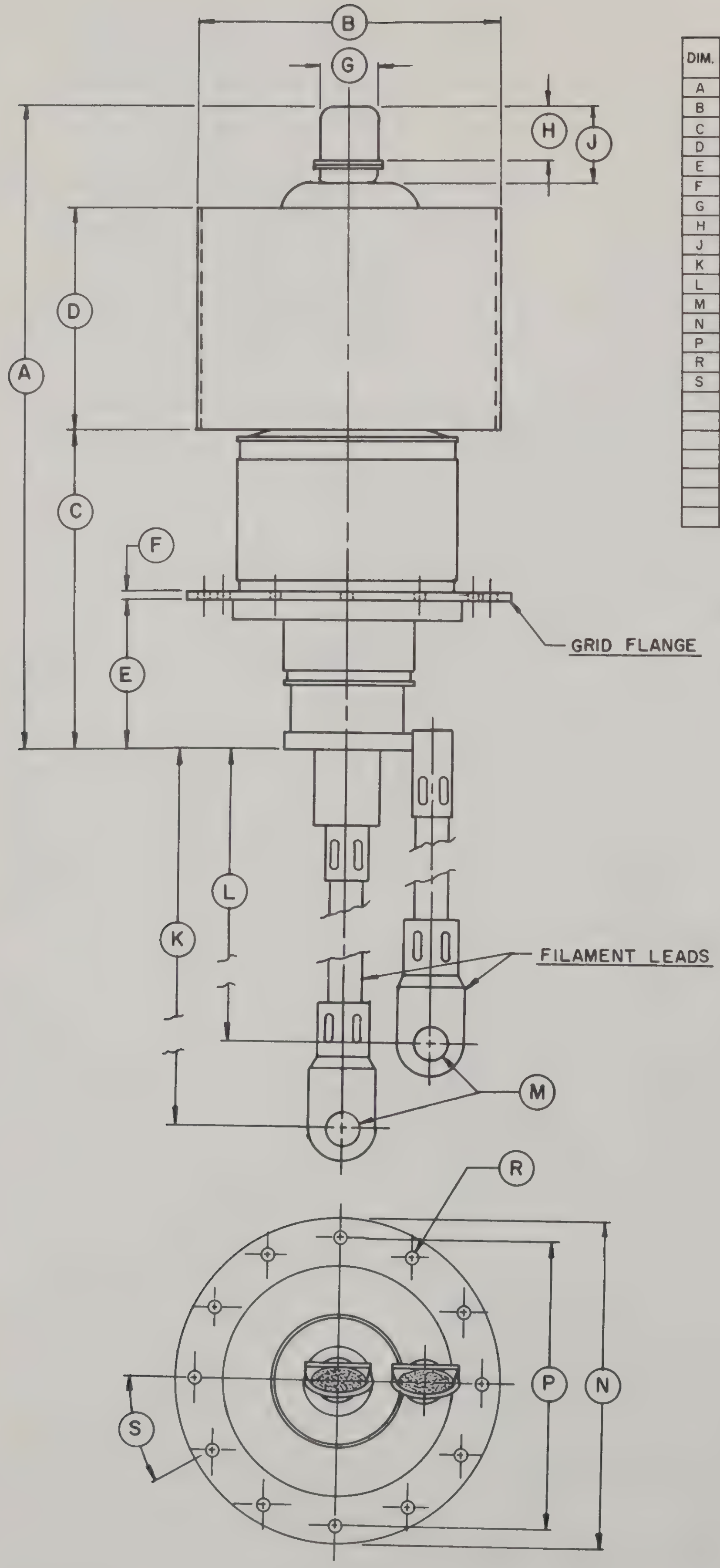
Plate over-current protection should be provided to remove plate voltage quickly in the event of an overload or an arc-over at the load. In addition current limiting power supply resistors should be used. These precautions are especially important in industrial service with its wide variations in loading.

Spark gaps from plate to ground should be used to prevent voltages from flashing across the tube envelope during any fault conditions.

HIGH FREQUENCY OPERATION - The 3CX-2500H3 is usable to 110 MHz. At this frequency, plate voltage must be reduced to 4000 volts in Class C service.

HIGH VOLTAGE - The 3CX2500H3 operates at voltages which can be deadly, and the equipment must be designed properly and operating precautions must be followed. Equipment must be designed so that no one can come in contact with high voltages. All equipment must include safety enclosures for high-voltage circuits and terminals, with interlock switches to open the primary circuits of the power supplies and to discharge high voltage condensers whenever access doors are opened. Interlock switches must not be bypassed or "cheated'' to allow operation with access doors open. Always remember that HIGH VOLTAGE CAN KILL.

SPECIAL APPLICATIONS - If it is desired to operate this tube under conditions widely different from those given here, write to Power Grid Tube Division, EIMAC Division of Varian, 301 Industrial Way, San Carlos, California 94070 for information and recommendations.

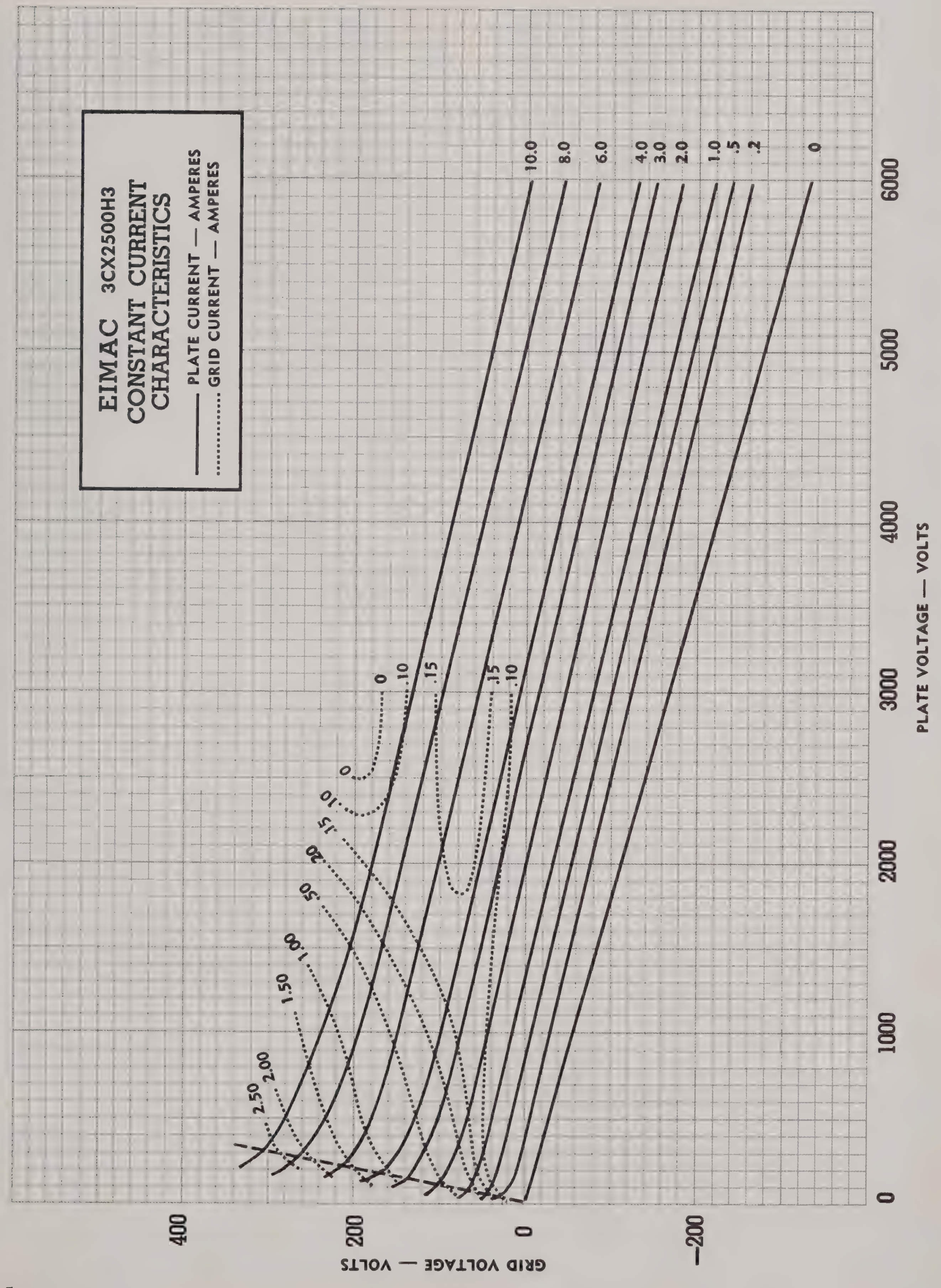


DIMENSIONAL DATA

DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	8.000	9.000	- -	203.20	228.60	- -
B	4.093	4.156	- -	103.96	105.56	- -
C	3.875	4.250	- -	98.43	107.95	- -
D	2.937	3.062	- -	74.60	77.77	- -
E	1.703	1.953	- -	43.26	49.61	- -
F	- -	- -	0.125	- -	- -	3.18
G	0.781	0.843	- -	19.84	21.41	- -
H	0.687	0.812	- -	17.45	20.62	- -
J	1.000	1.125	- -	25.40	28.58	- -
K	8.937	9.437	- -	227.00	239.70	- -
L	7.937	8.437	- -	201.60	214.30	- -
M	- -	- -	0.390	- -	- -	9.91
N	4.230	4.250	- -	107.44	107.95	- -
P	3.855	3.885	- -	97.92	98.68	- -
R	- -	- -	0.250	- -	- -	6.35
S	29°	31°	- -	29°	31°	- -

NOTES:

1. REFERENCE DIMENSIONS ARE FOR INFORMATION ONLY AND ARE NOT REQUIRED FOR INSPECTION PURPOSES.
2. THERE ARE 12 HOLES IN GRID FLANGE.
3. GRID FLANGE AND FILAMENT LEADS ARE TO BE ORIENTED AS SHOWN


EIMAC 3CX2500H3
CONSTANT CURRENT CHARACTERISTICS
—— PLATE CURRENT — AMPERES
.... GRID CURRENT — AMPERES
10.0
8.0
6.0
4.0
3.0
2.0
1.0
.5
.2
0
2.50
2.00
1.50
1.00
.50
.20
.15
.10
0
0
.10
.15
.15
.10
400
200
0
−200
GRID VOLTAGE — VOLTS
0
1000
2000
3000
4000
5000
6000
PLATE VOLTAGE — VOLTS

TECHNICAL DATA

3CX3000A7

HIGH-MU
POWER TRIODE

The EIMAC 3CX3000A7 is a ceramic/metal, high-mu, forced-air cooled, external anode transmitting triode with a maximum plate dissipation rating of 3000 watts. Relatively high power output as an amplifier, oscillator, or modulator may be obtained from this tube at low plate voltages. The 3CX3000A7 is an exact replacement for the EIMAC 3X3000A7. The all ceramic and metal construction insures a margin of safety with respect to tube operating temperatures while permitting higher processing temperatures to insure longer life.

The tube has a rugged, low inductance cylindrical filament-stem structure, which readily becomes part of a linear filament tank circuit for VHF operation. The grid provides thorough shielding between the input and output circuits for grounded-grid applications and is conveniently terminated in a ring between the plate and filament terminals.

The 3CX3000A7 is intended to be used as a zero bias class B amplifier in audio or radio frequency applications. Operation with zero grid bias offers circuit simplicity by eliminating the bias supply. In addition, grounded-grid operation is attractive, since a power gain of over twenty times can be obtained.

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Filament: Thoriated Tungsten	
Voltage	7.5 ± 0.37 V
Current, at 7.5 volts	51 A
Amplification Factor (Average)	160
Direct Interelectrode Capacitance (grounded filament)[2]	
Input	38.0 pF
Output	0.6 pF
Feedback	24.0 pF
Direct Interelectrode Capacitance (grounded grid)[2]	
Input	38.0 pF
Output	24.0 pF
Feedback	0.6 pF
Frequency of Maximum Rating:	
C W	110 MHz

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1. Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.
2. Capacitance values are for a cold tube as measured in a special shielded fixture.

(Revised 11-20-70) © 1967 by Varian Printed in U.S.A.

MECHANICAL

Maximum Overall Dimensions:

Length	9.000 in; 228.60 mm
Diameter	4.156 in; 105.56 mm
Net Weight	6.25 lb; 2.84 kg
Operating Position	Vertical, base down or up

Maximum Operating Temperature:

Ceramic/Metal Seals	250°C
Anode Core	250°C
Cooling	Forced Air
Base	Special Coaxial

RADIO FREQUENCY LINEAR AMPLIFIER CATHODE DRIVEN

Class AB_2

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE	5000	VOLTS
DC PLATE CURRENT	2.5	AMPERES
PLATE DISSIPATION	3000	WATTS
GRID DISSIPATION	225	WATTS

TYPICAL OPERATION (Frequencies to 30 MHz)
Class AB2, Grid Driven, Peak Envelope or Modulation Crest Conditions

Plate Voltage	4000	4800	4800	Vdc
Zero-Signal Plate Current[1]	0.25	0.35	0.35	Adc
Single-Tone Plate Current	2.00	1.68	2.00	Adc
Single-Tone Grid Current[1]	0.61	0.46	0.60	Adc
Peak Driving Power	420	293	410	w
Plate Dissipation	2285	2275	2775	W
Single-Tone Plate Output Power	6030	6000	7266	W
Resonant Load Impedance	1210	1720	1425	Ω
Driving Impedance	47.5	50.0	46.3	Ω

1. Approximate value.

RADIO FREQUENCY LINEAR AMPLIFIER, CARRIER CONDITIONS, GRID DRIVEN

Class AB_2

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE	5000	VOLTS
DC PLATE CURRENT	2.5	AMPERES
PLATE DISSIPATION	3000	WATTS
GRID DISSIPATION	225	WATTS

TYPICAL OPERATION (Frequencies to 30 MHz)
Class AB2, Grid Driven, Peak Envelope or Modulation Crest Conditions

Plate Voltage	4000	Vdc
Zero-Signal Plate Current[1]	0.25	Adc
DC Plate Current	0.74	Adc
DC Grid Current[1]	0.13	Adc
Peak rf Grid Voltage[1]	85.0	v
Peak Driving Power[1]	11.5	w
Plate Dissipation	1830	W
Single-Tone Plate Output Power	1130	W
Resonant Load Impedance	1750	Ω
Peak rf Plate Voltage	2000	v

1. Approximate value.

RADIO FREQUENCY POWER AMPLIFIER

Class C Telegraphy or FM Telephony, Cathode Driven (Key-Down Conditions)

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE	5000	VOLTS
DC PLATE CURRENT	2.5	AMPERES
PLATE DISSIPATION	3000	WATTS
GRID DISSIPATION	225	WATTS

TYPICAL OPERATION (Frequencies to 110 MHz)

Plate Voltage	3500	4800	Vdc
Grid Voltage	-50	-60	Vdc
Plate Current	1.30	1.54	Adc
Grid Current[1]	0.42	0.48	Adc
Peak rf Cathode Voltage[1]	220	267	v
Calculated Driving Power[1]	310	435	W
Plate Dissipation	985	1480	W
Useful Output Power[2]	3300	5500	W

1. Approximate value.
2. Output circuit and filter loss of 10% assumed.

AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR

Class AB_2, Grid Driven (Sinusoidal Wave)

ABSOLUTE MAXIMUM RATINGS (per tube)

DC PLATE VOLTAGE	5000	VOLTS
DC PLATE CURRENT	2.5	AMPERES
PLATE DISSIPATION	3000	WATTS
GRID DISSIPATION	225	WATTS

TYPICAL OPERATION (Two Tubes)

Plate Voltage	4000	Vdc
Zero-Signal Plate Current [1]	0.50	Adc
Max. Signal Plate Current	3.58	Adc
Max. Signal Grid Current [1]	0.58	Adc
Peak af Grid Voltage [2]	190	v
Peak Driving Power [3]	115	w
Max. Signal Plate Dissipation	1850	W
Plate Output Power	10,500	W
Load Resistance (plate to plate)	2720	Ω

1. Approximate value.
2. Per tube.
3. Nominal drive power is one-half peak power.

NOTE: TYPICAL OPERATION data are obtained by measurement or calculation from published characteristic curves. Adjustment of the rf grid voltage to obtain the specified plate current at the specified bias, and plate voltages is assumed. If this procedure is followed, there will be little variation in output power when the tube is changed, even though there may be some variation in grid current. The grid current which results when the desired plate current is obtained is incidental and varies from tube to tube. These current variations cause no difficulty so long as the circuit maintains the correct voltage in the presence of the variations in current. If grid bias is obtained principally by means of a grid resistor, the resistor must be adjustable to obtain the required bias voltage when the correct rf grid voltage is applied.

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.	
Filament: Current at 7.5 volts	49.0	54.0	A
Interelectrode Capacitances [1] (grounded filament connection)			
Input	30.0	45.0	pF
Output	---	1.0	pF
Feedback	20.0	28.0	pF
Interelectrode Capacitances [1] (grounded grid connection)			
Input	30.0	45.0	pF
Output	20.0	28.0	pF
Feedback	---	1.0	pF
Zero Bias Plate Current (E_b = 5000 volts)	0.36	0.52	A
Cut-off Bias (E_b = 5000 volts, I_b = 1.0 mAdc)	---	-45.0	V

1. Capacitance values are for a cold tube as measured in a shielded fixture.

APPLICATION

INPUT CIRCUIT - When the 3CX3000A7 is operated as a grounded-grid rf amplifier, the use of a resonant tank in the cathode circuit is recommended in order to obtain greatest linearity and power output. For best results with a single-ended amplifier it is suggested that the cathode tank circuit operate at a "Q" of two or more.

COOLING - The maximum temperature rating for the anode core and seals of the 3CX3000A7 is 250°C. Sufficient forced-air cooling must be provided to keep the temperature of the anode core and the temperatures of the ceramic/metal seals below 250°C. Tube life is usually prolonged if these areas are maintained at temperatures below the maximum rating. Minimum air flow requirements to maintain anode-core and seal temperatures below 250°C at sea level with an inlet-air temperature of 50°C are tabulated for air-flow in the anode-to-base and base-to-anode directions. At higher ambient temperatures, frequencies above 30 MHz or at higher altitude, a greater quantity of air will be required. It is suggested that temperatures be monitored in any new installation to insure proper cooling.

Base-to-Anode Air Flow				
*	Sea Level		10,000 Feet	
Anode Dissipation watts	Air Flow CFM	Pressure Drop inches water	Air Flow CFM	Pressure Drop inches water
1500	32	0.6	47	0.9
2500	57	1.0	83	1.5
3000	64	1.07	93.4	1.56

Anode-to-Base Air Flow[1]				
*	Sea Level		10,000 Feet	
Anode Dissipation watts	Air Flow CFM	Pressure Drop inches water	Air Flow CFM	Pressure Drop inches water
1500	33	0.6	48	0.9
2500	66	1.25	96	1.82
3000	72	1.40	105	2.04

*Since the power dissipated by the filament represents about 385 watts and since grid dissipation can, under some conditions represent another 225 watts, allowance has been made in preparing this tabulation for an additional 610 watts.

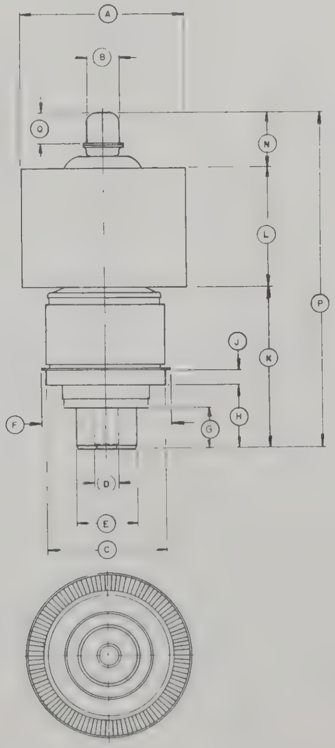
[1] When air is supplied in the anode-to-base direction, a minimum of 3 cfm must be directed into the filament-stem structure between the inner and outer filament terminals to maintain the base seals below 250° C. No separate air is required with base-to-anode air-flow.

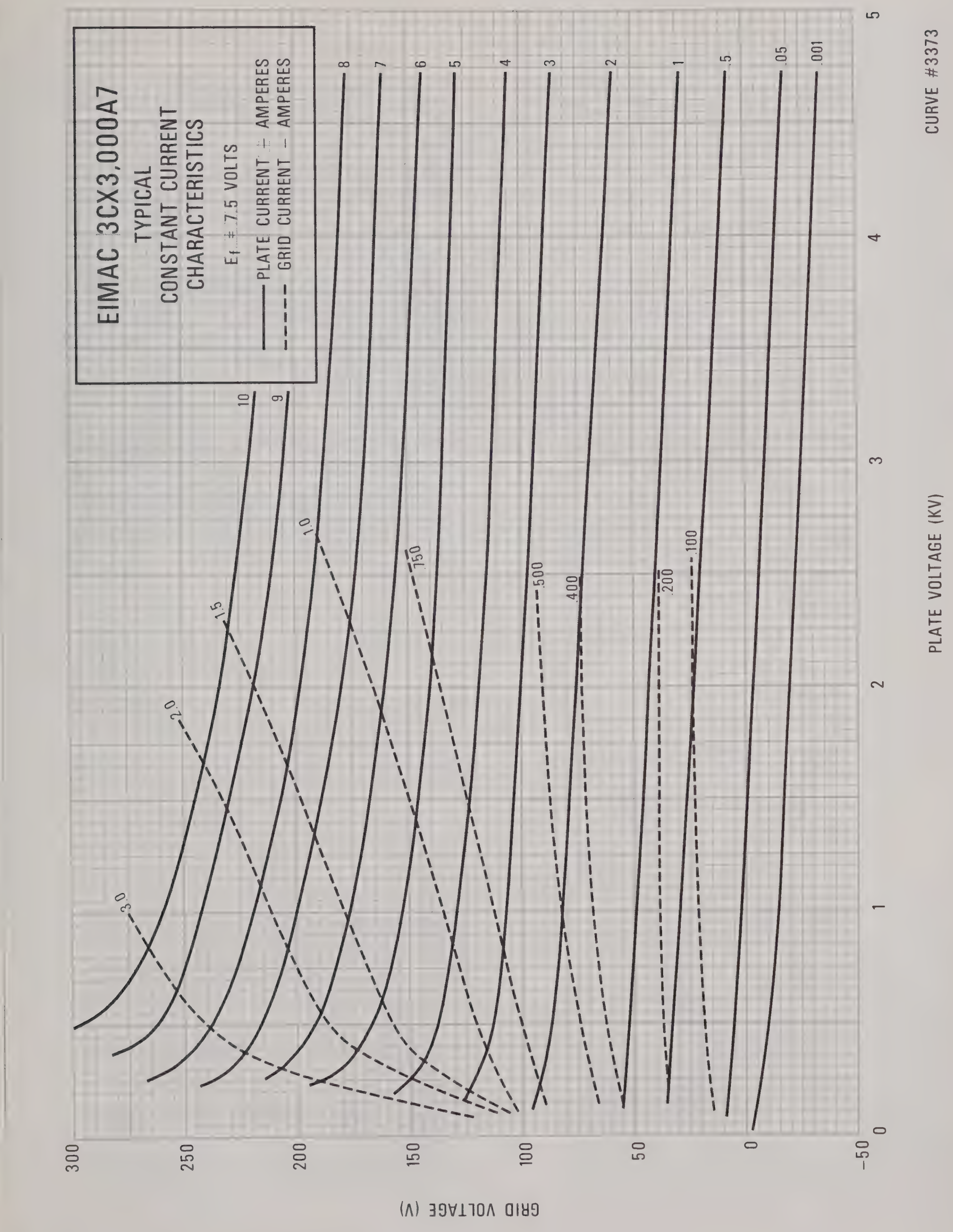
HIGH VOLTAGE - The 3CX3000A7 operates at voltages which can be deadly, and the equipment must be designed properly and operating precautions must be followed. Equipment must be designed so that no one can come in contact with high voltages. All equipment must include safety enclosures for high-voltage circuits and terminals, with interlock switches to open the primary circuits of the power supplies and to discharge high voltage condensers whenever access doors are opened. Interlock switches must not be bypasses or ''cheated'' to allow operation with access doors open. Always remember that HIGH VOLTAGE CAN KILL.

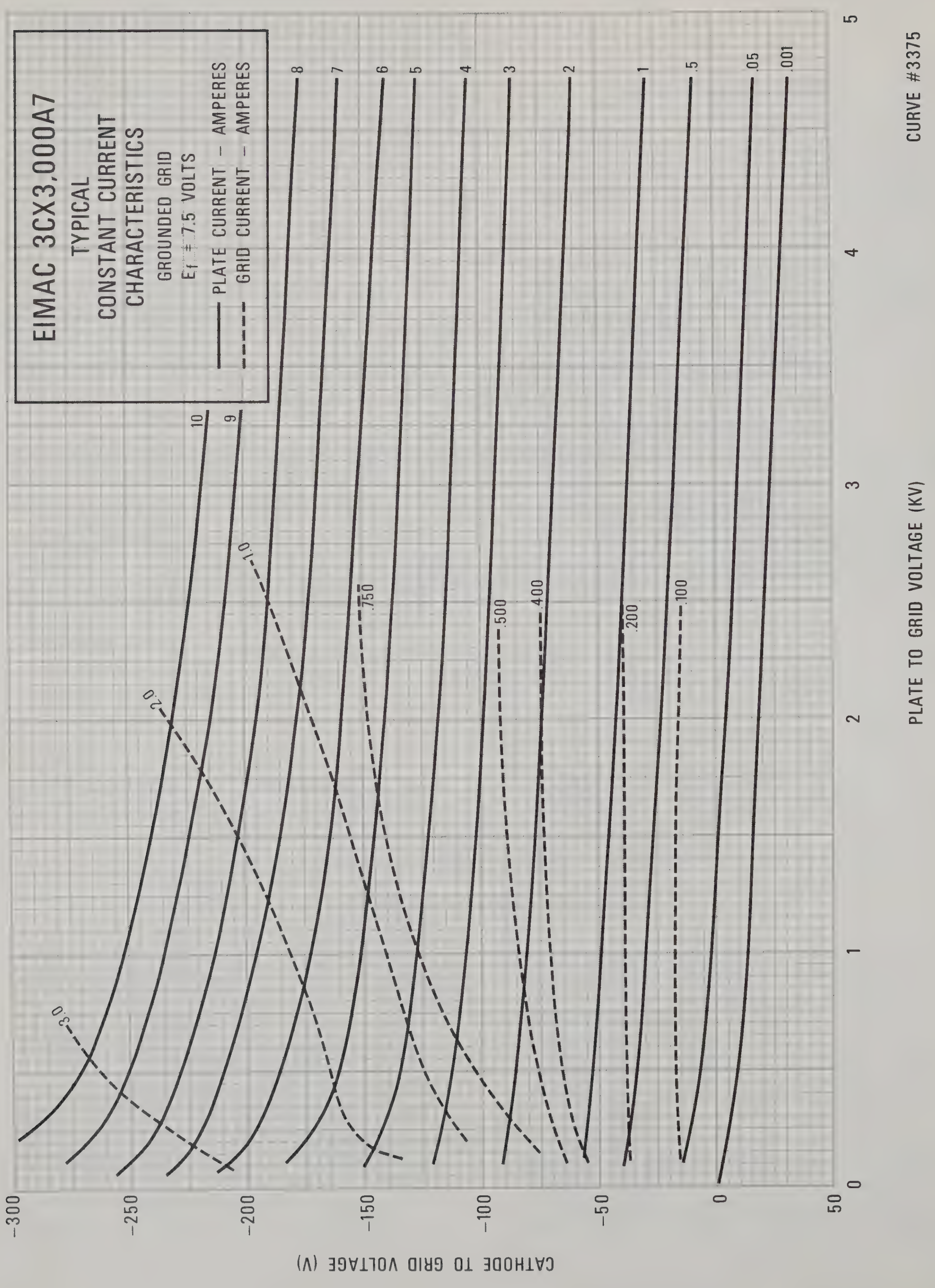
SPECIAL APPLICATIONS - If it is desired to operate this tube under conditions widely different from those given here, write to Power Grid Tube Division, EIMAC, Division of Varian, 301 Industrial Way, San Carlos, California 94070 for information and recommendations.

DIMENSIONAL DATA						
DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	4.094	4.156	- -	103.99	105.56	- -
B	0.781	0.844	- -	19.83	21.44	- -
C	2.990	3.010	- -	75.95	76.45	- -
D	0.615	0.635	- -	15.62	16.13	- -
E	1.490	1.510	- -	37.85	38.35	- -
F	- -	3.625	- -	- -	92.08	- -
G	0.813	0.937	- -	20.65	23.80	- -
H	1.375	1.625	- -	34.92	41.28	- -
J	0.391	0.422	- -	9.93	10.72	- -
K	3.875	4.250	- -	98.43	107.95	- -
L	2.937	3.063	- -	74.60	77.80	- -
N	1.187	1.687	- -	30.15	42.85	- -
P	8.000	9.000	- -	203.20	228.60	- -
Q	0.687	0.813	- -	17.45	20.65	- -

NOTES.
1. REF DIMENSIONS ARE FOR INFO. ONLY & ARE NOT REQUIRED FOR INSPECTION PURPOSES.



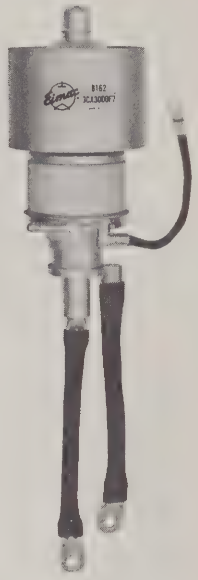

EIMAC 3CX3,000A7
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
E_f = 7.5 VOLTS
PLATE CURRENT — AMPERES
GRID CURRENT — AMPERES
10
9
8
7
6
5
4
3
2
1
.5
.05
.001
3.0
2.0
1.5
1.0
.750
.500
.400
.200
.100
GRID VOLTAGE (V)
300
250
200
150
100
50
0
−50
PLATE VOLTAGE (KV)
0
1
2
3
4
5
CURVE #3373


EIMAC 3CX3,000A7
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
GROUNDED GRID
E_f = 7.5 VOLTS
PLATE CURRENT – AMPERES
GRID CURRENT – AMPERES
10
9
8
7
6
5
4
3
2
1
.5
.05
.001
3.0
2.0
1.0
.750
.500
.400
.200
.100
–300
–250
–200
–150
–100
–50
0
50
CATHODE TO GRID VOLTAGE (V)
0
1
2
3
4
5
PLATE TO GRID VOLTAGE (KV)
CURVE #3375

E I M A C
Division of Varian
SAN CARLOS
CALIFORNIA

8162
3CX3000F7

HIGH-MU POWER TRIODE



The EIMAC 8162/3CX3000F7 is a ceramic/metal, high mu, forced air cooled power triode intended for use as an amplifier, oscillator or modulator. The maximum rated plate dissipation is 3000 watts. The 8162/3CX-3000F7 provides relatively high power output at low plate voltages and is an exact replacement for the EIMAC 3X3000F7. The ceramic/metal construction allows a good margin of safety with respect to tube operating temperatures while permitting high processing temperatures to insure longer life.

The 8162/3CX3000F7 is intended to be used as a zero bias class B amplifier in audio or radio frequency applications. Operation with zero bias offers circuit simplicity by eliminating the bias supply. In addition, grounded grid operation is attractive, since a power gain of over 20 can be obtained.

The 8162/3CX3000F7 is provided with "flying leads" for filament and grid connections.

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Filament: Thoriated Tungsten	
Voltage	7.5 ± 0.375 V
Current, at 7.5 volts	51 A
Amplification Factor (Average):	160
Direct Interelectrode Capacitance (grounded cathode)[2]	
Input	38.0 pF
Output	0.6 pF
Feedback	24.0 pF
Direct Interelectrode Capacitance (grounded grid)[2]	
Input	38.0 pF
Output	24.0 pF
Feedback	0.6 pF
Frequency of Maximum Rating:	
CW	30 MHz

[1] Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.

[2] In Shielded Fixture.

MECHANICAL

Maximum Overall Dimensions:	
Length (less filament leads)	9.000 in; 227.60 mm
Diameter	4.156 in; 105.56 mm

Effective 5-7-70 © by Varian Printed in U.S.A.

Net Weight	6.25 lb; 2.84 kg
Operating Position	Vertical, base up or down
Maximum Operating Temperature :	
Ceramic/Metal Seals	250°C
Anode Core	250°C
Cooling	Forced Air
Base	Special, see outline drawing

RADIO FREQUENCY LINEAR AMPLIFIER CATHODE DRIVEN, GROUNDED GRID

Class B

ABSOLUTE MAXIMUM RATINGS:

DC PLATE VOLTAGE	5000	VOLTS
DC PLATE CURRENT	2.5	AMPERES
PLATE DISSIPATION	3000	WATTS
GRID DISSIPATION	225	WATTS

TYPICAL OPERATION (Frequencies to 30 MHz)
Class B, Cathode Driven, Peak Envelope or Modulation Crest Conditions

Plate Voltage	4000	4800	4800	Vdc
Zero-Signal Plate Current[1]	0.32	0.44	0.44	Adc
Single-Tone Plate Current	2.00	1.68	2.00	Adc
Two-Tone Plate Current	1.28	1.11	1.33	Adc
Single-Tone Grid Current[1]	0.50	0.34	0.45	Adc
Two-Tone Grid Current[1]	0.25	0.19	0.24	Adc
Peak rf Cathode Voltage[1]	210	182	208	v
Peak Driving Power	420	293	410	w
Driving Impedance[1]	48	50	46	Ω
Plate Dissipation	2285	2275	2775	W
Single-Tone Useful Output Power[3]	5700	5200	6620	W
Power Gain[1]	11.5	13.2	12.6	db
Resonant Load Impedance	1210	1720	1425	Ω
Intermodulation Distortion Products[2]				
3rd Order	-38	-42	-38	db
5th Order	-38	-42	-38	db

1. Approximate
2. The intermodulation distortion products are referenced against one tone of a two equal tone signal.
3. Power measured at the load.

RADIO FREQUENCY LINEAR AMPLIFIER GRID DRIVEN, CARRIER CONDITIONS

Class B

ABSOLUTE MAXIMUM RATINGS:

DC PLATE VOLTAGE	5000	VOLTS
DC PLATE CURRENT	2.5	AMPERES
PLATE DISSIPATION	3000	WATTS
GRID DISSIPATION	225	WATTS

TYPICAL OPERATION (Frequencies to 30 MHz)
Class B, Grid Driven, Peak Envelope or Modulation Crest Conditions

Plate Voltage	4000	Vdc
Grid Voltage	0	Vdc
Zero-Signal Plate Current[1]	0.32	Adc
Single-Tone Plate Current	0.74	Adc
Single-Tone Grid Current[1]	0.14	Adc
Peak rf Grid Voltage[1]	85	v
Peak Driving Power	11.5	w
Plate Dissipation	1830	W
Peak rf Plate Voltage	2000	v
Single-Tone Plate Output Power	1130	W
Resonant Load Impedance	1750	Ω

1. Approximate value.

AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR

Class B, Grid Driven (Sinusoidal Wave)

ABSOLUTE MAXIMUM RATINGS (per tube)

DC PLATE VOLTAGE	5000	VOLTS
DC PLATE CURRENT	2.5	AMPERES
PLATE DISSIPATION	3000	WATTS
GRID DISSIPATION	225	WATTS

TYPICAL OPERATION (Two Tubes)

Plate Voltage	4000	Vdc
Grid Voltage	0	Vdc
Zero-Signal Plate Current	0.64	Adc
Max. Signal Plate Current	3.58	Adc
Max. Signal Grid Current[1]	0.59	mAdc
Peak af Grid Voltage[2]	190	v
Peak Driving Power[3]	115	w
Max. Signal Plate Dissipation	3700	W
Plate Output Power	10.5	kW
Load Resistance (plate to plate)	2720	Ω

1. Approximate value.
2. Per tube.
3. Nominal drive power is one-half peak power.

NOTE: TYPICAL OPERATION data are obtained direct measurement or by calculation from published characteristic curves. Adjustment of the rf grid voltage to obtain the specified plate current at the specified bias and plate voltage is assumed. If this procedure is followed, there will be little variation in output power when the tube is changed, even though there may be some variation in grid current. The grid current which results when the desired plate current is obtained is incidental and varies from tube to tube. This current variations causes no difficulty so long as the circuit maintains the correct voltage in the presence of the variations in current.

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.	
Filament: Current at 7.5 volts	48.0	53.0	A
Interelectrode Capacitances[1] (grounded cathode connection)			
Input	30.0	45.0	pF
Output	---	1.0	pF
Feedback	20.0	28.0	pF
Interelectrode Capacitances [1] (grounded grid connection)			
Input	30.0	45.0	pF
Output	20.0	28.0	pF
Feedback	---	1.0	pF
Zero Bias Plate Current (E_b = 5000 volts)	0.36	0.52	A
Cut-off Bias (E_b = 5000 volts, I_b = 1.0 mAdc)	---	-45.0	V

1. Capacitance values are for a cold tube as measured in a shielded fixture.

APPLICATION

MECHANICAL

COOLING - The maximum temperature rating for the anode core and seals of the 3CX3000F7 is 250°C. Sufficient forced-air cooling must be provided to keep the temperature of the anode core and the temperatures of the ceramic/metal seals below 250°C. Tube life is useally prolonged if these areas are maintained at temperatures below the maximum rating. Minimum air flow requirements to maintain anode-core and seal temperatures below 250°C at sea level with an inlet-air temperature of 50°C are tabulated for air-flow in the anode-to-base and base-to-anode directions. At higher ambient temperatures or at higher altitude, a greater quantity of air will be required. It is suggested that temperatures be monitored in any new installation to insure proper cooling.

Tube temperatures may be measured with a temperature sensitive paint, spray, or crayon such as manufactured by Tempil Division, Big Three Industrial Gas & Equipment Co., Hamilton Blvd., So. Plainfield, N.J. 07080.

Base-to-Anode Air Flow

	Sea Level		10,000 Feet	
Anode Dissipation watts	Air Flow CFM	Pressure Drop Inches water	Air Flow CFM	Pressure Drop Inches water
1500	32	.6	47	.9
2500	57	1.0	83	1.5
3000	64	1.07	93.4	1.56

Since the power dissipated by the filament represents about 385 watts and since grid dissipation can, under some conditions represent another 225 watts, allowance has been made in preparing this tabulation for an additional 610 watts.

Anode-to-Base Air Flow[1]

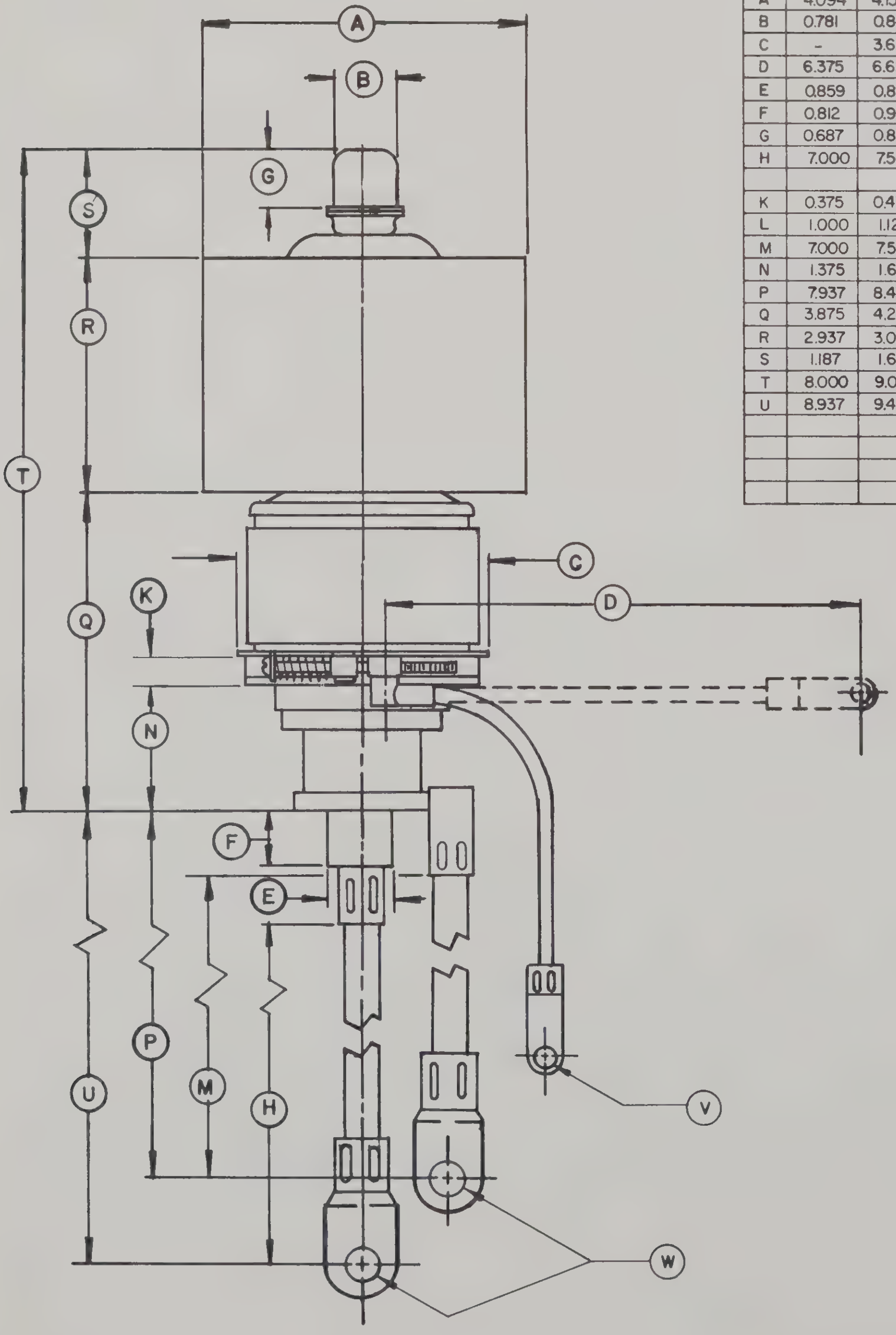
	Sea Level		10,000 Feet	
Anode Dissipation watts	Air Flow CFM	Pressure Drop Inches water	Air Flow CFM	Pressure Drop Inches water
1500	33	.6	48	.9
2500	66	1.25	96	1.82
3000	72	1.40	105	2.04

[1] When air is supplied in the anode-to-base direction, a minimum of 3 cfm must be directed into the filament-stem structure between the inner and outer filament terminals to maintain the base seals below 250°C. No separate air is required with base-to-anode airflow.

ELECTRICAL

INPUT CIRCUIT - When the 3CX3000F7 is operated as a grounded-grid rf amplifier, the use of a resonant tank in the cathode circuit is reccommended in order to obtain greatest linearity and power output. For best results with a single-ended amplifier it is suggested that the cathode tank circuit operate at a Q of five or more.

SPECIAL APPLICATION - If it is desired to operate this tube under conditions widely different from those listed here, write to Power Grid Tube Division, EIMAC Division of Varian, 301 Industrial Way, San Carlos, California 94070, for information and recommendations.

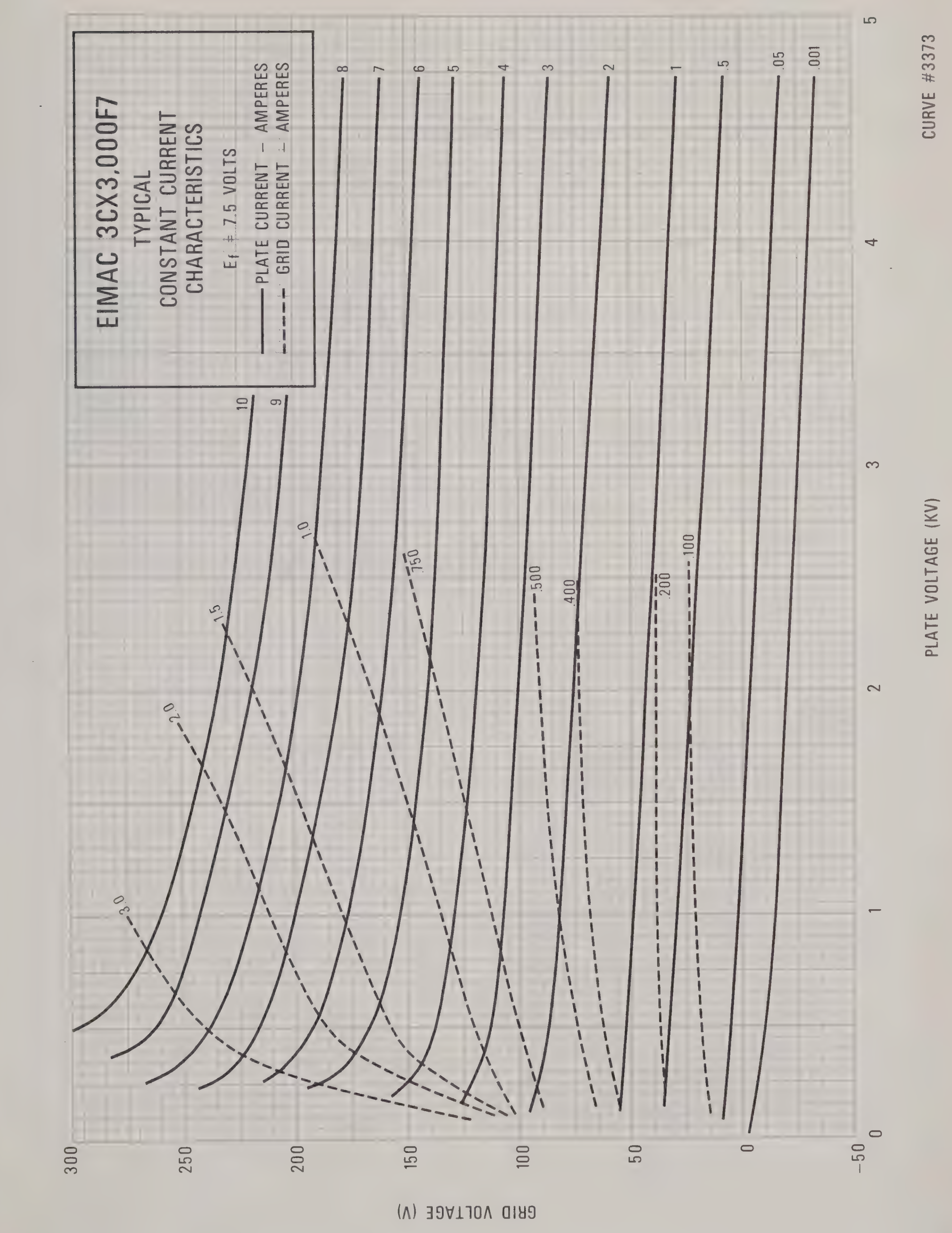


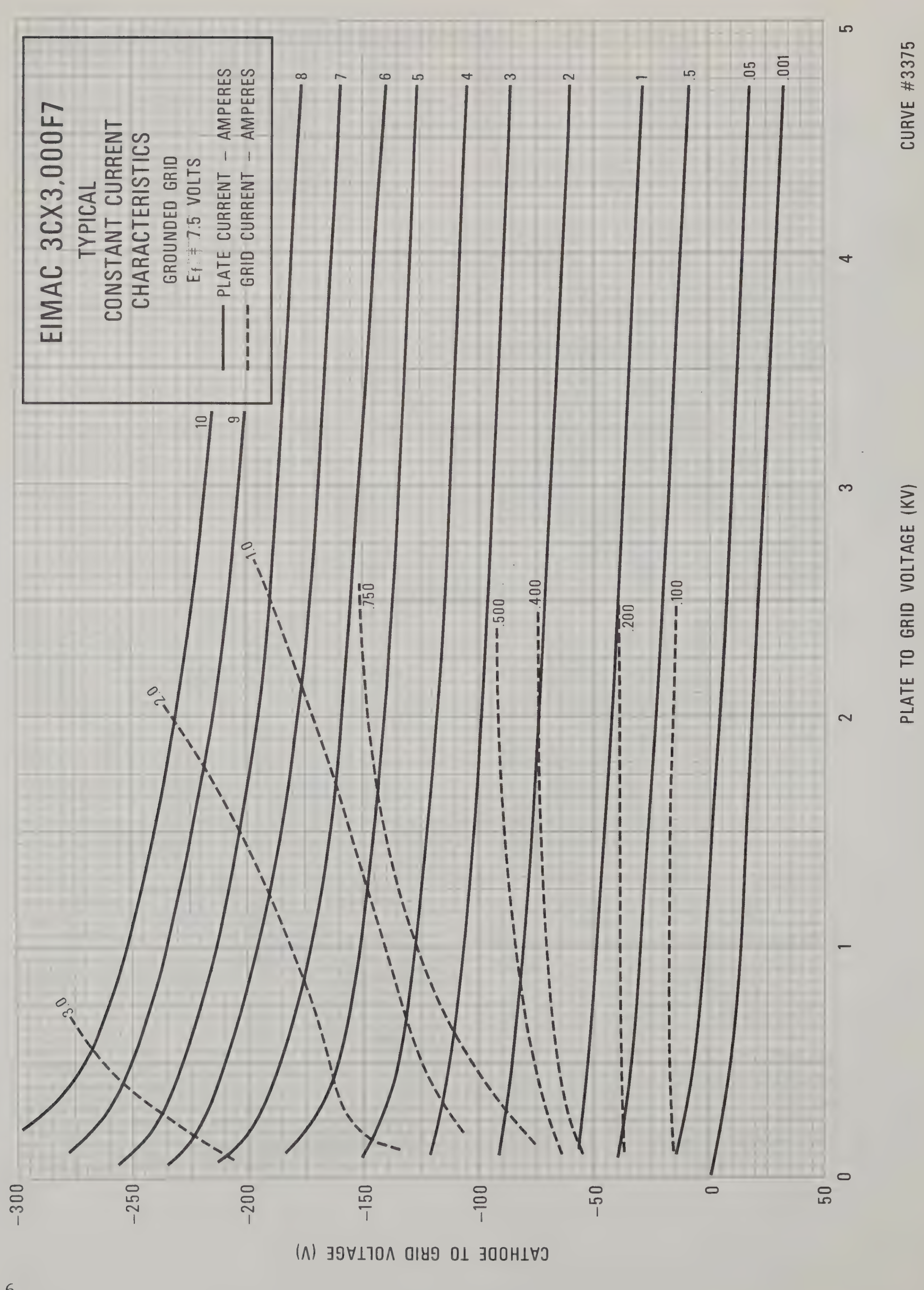
DIMENSIONAL DATA

DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	4.094	4.156		103.99	105.56	
B	0.781	0.844		19.84	21.44	
C	-	3.625		-	92.08	
D	6.375	6.625		161.93	168.28	
E	0.859	0.890		21.82	22.61	
F	0.812	0.937		20.62	23.80	
G	0.687	0.813		17.45	20.65	
H	7.000	7.500		177.80	190.50	
K	0.375	0.437		9.53	11.10	
L	1.000	1.125		25.40	28.58	
M	7.000	7.500		177.80	190.50	
N	1.375	1.625		34.93	41.28	
P	7.937	8.437		201.60	214.30	
Q	3.875	4.250		98.43	107.95	
R	2.937	3.063		201.60	214.30	
S	1.187	1.687		30.15	42.85	
T	8.000	9.000		203.20	228.60	
U	8.937	9.437		227.00	239.70	

NOTES:

1. REF. DIMENSIONS ARE FOR INFO. ONLY & ARE NOT REQUIRED FOR INSPECTION PURPOSES.


EIMAC 3CX3,000F7
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
Ef = 7.5 VOLTS
PLATE CURRENT – AMPERES
GRID CURRENT – AMPERES
10
9
8
7
6
5
4
3
2
1
.5
.05
.001
3.0
2.0
1.5
1.0
.750
.500
.400
.200
.100
300
250
200
150
100
50
0
–50
GRID VOLTAGE (V)
0
1
2
3
4
5
PLATE VOLTAGE (KV)
CURVE #3373


EIMAC 3CX3,000F7
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
GROUNDED GRID
E_f = 7.5 VOLTS
PLATE CURRENT — AMPERES
GRID CURRENT — AMPERES
10
9
8
7
6
5
4
3
2
1
.5
.05
.001
3.0
2.0
1.0
.750
.500
.400
.200
.100
-300
-250
-200
-150
-100
-50
0
50
CATHODE TO GRID VOLTAGE (V)
0
1
2
3
4
5
PLATE TO GRID VOLTAGE (KV)

CURVE #3375

Eimac®
EITEL-McCULLOUGH, INC.
SAN CARLOS CALIFORNIA

8158
3CX10,000A1
LOW-MU POWER TRIODE

The Eimac 8158/3CX10,000A1 is a ceramic and metal power triode intended primarily for use as an audio amplifier or modulator. This tube is also recommended for voltage-regulator applications where high current capability and low tube drop are important. Up to 12 kilowatts of plate power can be dissipated on its air-cooled anode. A water-cooled version, the 3CW20,000A1, is available with a 20 kw dissipation rating.

GENERAL CHARACTERISTICS

ELECTRICAL

	Min.	Nom.	Max.	
Filament: Thoriated-Tungsten				
Voltage - - - - - -		7.5		volts
Current - - - - - -	94		104	amps
Amplification Factor - - - - -	5.5		7.0	
Interelectrode Capacitances:				
Grid-Filament - - - - -	45		57	μμf
Grid-Plate - - - - -	25		32	
Transconductance (Ib = 2.0 amps, Eb = 3000 volts)		20,000		umhos
Frequency for Maximum ratings - - - -			140	Mc

MECHANICAL

Base	Coaxial
Recommended Socket	Eimac SK-1300
Recommended Chimney	Eimac SK-1306
Operating Position	Vertical, base up or down
Cooling	Forced air
Maximum Operating Temperatures:	
Anode Core	250°C
Ceramic-to-Metal Seals	250°C
■ Maximum Dimensions:	
Height	8.75 inches
Diameter	7.0 inches
Net Weight	12 pounds

AUDIO-FREQUENCY AMPLIFIER OR MODULATOR CLASS-AB$_1$

MAXIMUM RATINGS (Per Tube)

DC PLATE VOLTAGE - -	7000	MAX. VOLTS
DC PLATE CURRENT - -	5.0	MAX. AMPS
PLATE DISSIPATION - -	12	MAX. KW
GRID DISSIPATION - -	100	MAX. WATTS

*Adjust for zero-signal plate current
**At max-signal without negative feedback

Effective grid circuit resistance must not exceed 200,000 ohms

TYPICAL OPERATION, Two Tubes, Sinusoidal Wave

DC Plate Voltage - -	7000	7000 volts
DC Grid Voltage* - -	-1300	-1300 volts
Zero-Sig DC Plate Current	1.5	1.5 amps
Max-Sig DC Plate Current	5.8	7.0 amps
Load Resistance, Plate-to-Plate - - - -	2460	1720 ohms
Peak AF Grid Driving Voltage (Per tube) - - -	1300	1300 volts
Max-Sig Driving Power -	0	0 watts
Max-Sig Plate Output Power - -	24,400	29,100 watts
Total Harmonic Distortion**	2.9	3.6 percent

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■ Indicates change from data sheet dated 5-25-61

AUDIO-FREQUENCY AMPLIFIER OR MODULATOR Class-A

MAXIMUM RATINGS

DC PLATE VOLTAGE - -	7000 MAX. VOLTS
DC PLATE CURRENT - -	See Class-A derating table on Page 3
PLATE DISSIPATION - -	12,000 MAX. WATTS
GRID DISSIPATION - -	100 MAX. WATTS

TYPICAL OPERATION

DC Plate Voltage - - - -	2500 volts
DC Grid Voltage* - - - -	–290 volts
DC Plate Current - - - -	4.0 amps
Peak AF Grid Driving Voltage -	290 volts
Load Resistance - - - -	2120 ohms
Max. Signal Plate Output Power -	1800 watts
Second Harmonic Distortion** -	6.75 percent

*Adjust to give listed zero-signal DC plate current

**At maximum signal without negative feedback

RADIO-FREQUENCY INDUSTRIAL OSCILLATOR

Class-C

MAXIMUM RATINGS

DC PLATE VOLTAGE - -	5000 MAX. VOLTS
DC PLATE CURRENT - -	4.0 MAX. AMPS
PLATE DISSIPATION - -	10,000 MAX. WATTS
GRID DISSIPATION - -	100 MAX. WATTS

TYPICAL OPERATION

DC Plate Voltage - - - -	5000 volts
DC Grid Voltage - - - -	–1500 volts
DC Plate Current - - - -	2.75 amps
DC Grid Current - - - -	200 mA
Driving Power - - - - -	385 watts
Plate Output Power - - -	11,000 watts

VOLTAGE REGULATOR SERVICE

Class-A

MAXIMUM RATINGS

DC PLATE VOLTAGE - -	10,000 MAX. VOLTS
DC PLATE CURRENT - -	See Class-A derating table on Page 3
PLATE DISSIPATION - -	12,000 MAX. WATTS
GRID DISSIPATION - -	100 MAX. WATTS

TYPICAL OPERATION

DC Plate Voltage (tube drop) -	0-5000 volts
DC Plate Current - - - -	0-5 amps

(These values are chosen according to Class-A derating table on Page 3)

Note: "TYPICAL OPERATION" data are obtained by calculation from published characteristic curves. No allowance for circuit losses, either input or output, has been made.

■ COOLING AIR-FLOW DATA

PLATE DISSIPATION (watts)*	BASE-TO-ANODE AIR-FLOW		ANODE-TO-BASE AIR-FLOW**	
	Quantity (CFM)	Static Pressure (inches of water)	Quantity (CFM)	Static Pressure (inches of water)
4,000	90	0.18	135	0.3
6,000	155	0.4	250	0.7
8,000	230	0.7	405	1.5
10,000	315	1.2	590	2.6
12,000	415	1.7	800	4.0

*Since the power dissipated by the filament is about 750 watts and since grid dissipation can, under some circumstances, represent another 100 watts, allowance has been made in preparing this tabulation for an additional 850 watts dissipation.

**Separate base cooling may be required.

■ Indicates change from data sheet dated 5-25-61

APPLICATION

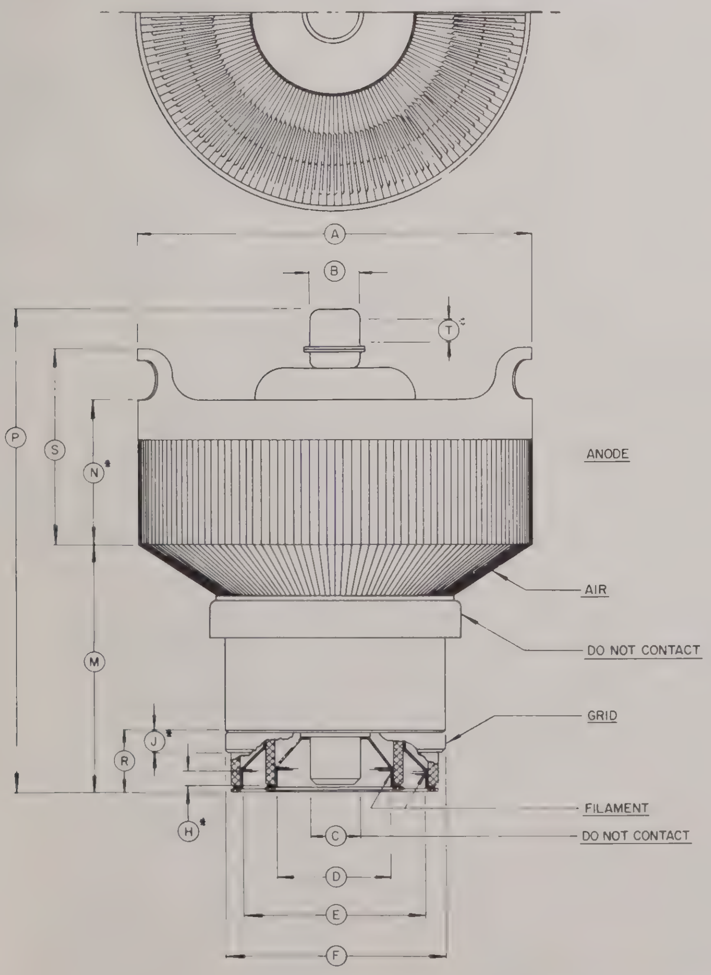
Voltage-Regulator Service — Maximum DC plate current and voltage are restricted according to the following table.

CLASS-A DERATING TABLE	
DC Plate Voltage (Volts)	Max. DC Plate Current (mA)
0 - 2400	5000
3000	4000
4000	3000
5000	2000
6000	1500
7000	1000
8000	700
9000	500
10,000	350

Filament Operation—The rated filament voltage for the 3CX10,000A1 is 7.5 volts. Filament voltage, as measured at the socket, should not be allowed to deviate from the rated value by more than plus or minus five percent.

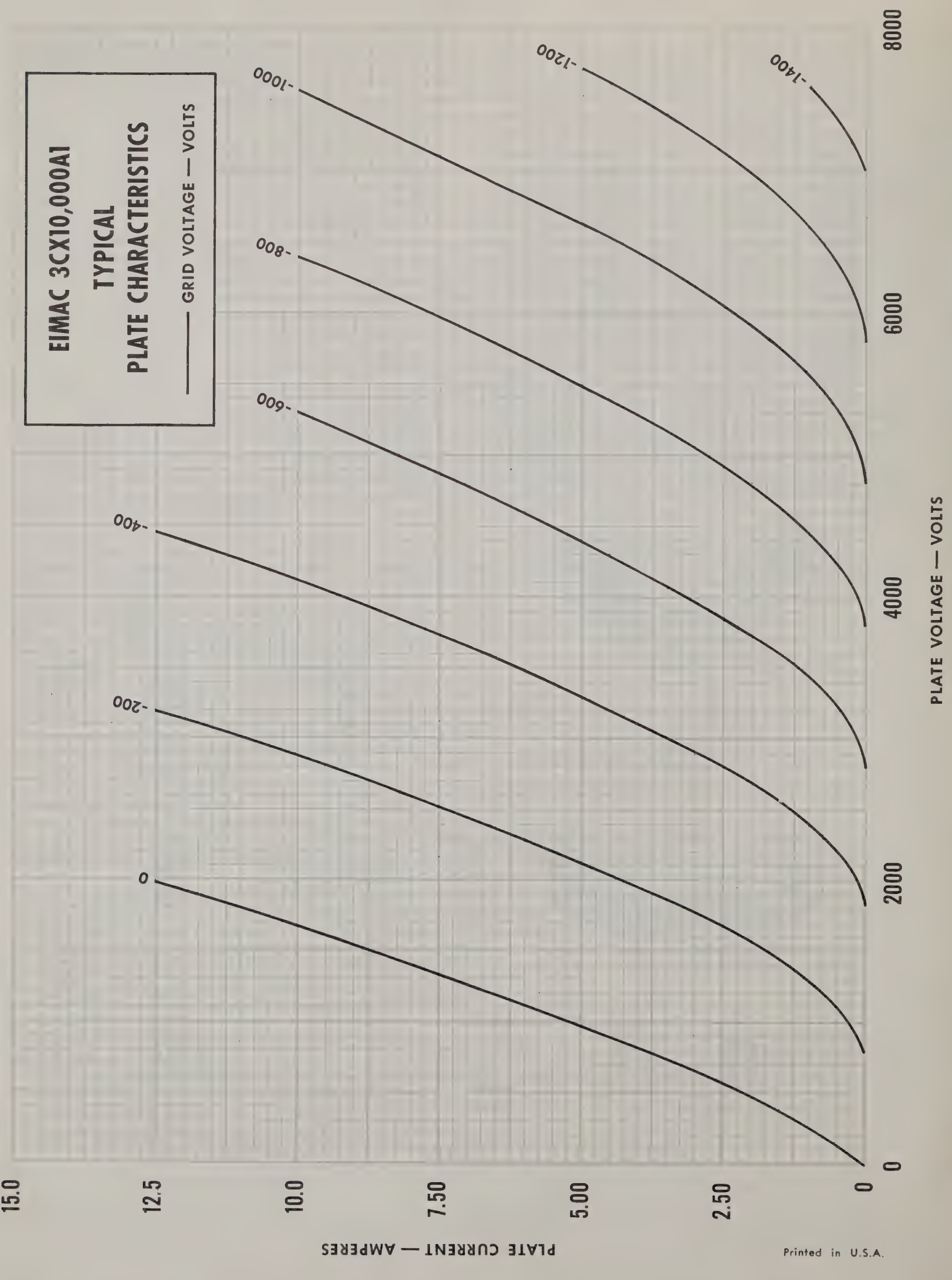
Cooling—The maximum temperature rating for the external surfaces of the 3CX10,000A1 is 250°C. Sufficient forced-air cooling must be provided to maintain the temperature of the ceramic-metal seals and anode core below 250°C. Tube life is usually prolonged if these areas are maintained at temperatures below this maximum rating. Minimum air-flow requirements to maintain anode-core and seal temperatures below 225°C with an inlet-air temperature of 50°C are tabulated. The use of these air-flow rates provides effective cooling of the tube. When air-flow is in the anode-to-base direction, special care must be taken to insure adequate cooling of the filament stem structure. A separate supply of air may have to be directed into the area between the filament contact areas to maintain safe seal temperatures.

Special Applications—If it is desired to operate this tube under conditions widely different from those given here, write to Power Grid Tube Marketing, Eitel-McCullough, Inc., 301 Industrial Way, San Carlos, Calif., for information and recommendations.



*CONTACT SURFACE
ALL DIMENSIONS IN INCHES

DIMENSION DATA			
REF.	NOM.	MIN.	MAX.
A		6.928	7.050
B		.855	.895
C		.720	.760
D		1.896	1.936
E		3.133	3.173
F		3.792	3.832
H		.188	
J		.188	
M		3.950	4.300
N		2.412	2.788
P		8.250	8.750
R		.986	1.050
S		3.412	3.788
T		.375	



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Eimac® EITEL-McCULLOUGH, INC.

TENTATIVE DATA

8159

3CX10,000A3

MEDIUM-MU POWER TRIODE

The Eimac 3CX10,000A3 is a ceramic and metal power triode intended primarily for use as a power oscillator in industrial-heating applications. It is also recommended for use as a grounded-grid FM amplifier, as a conventional plate-modulated amplifier, or as a linear amplifier.

GENERAL CHARACTERISTICS

▶ ELECTRICAL

Filament: Thoriated-Tungsten	Min.	Nom.	Max.	
Voltage		7.5		volts
Current	94		104	amperes
Amplification Factor		20		
Interelectrode Capacitances, Grounded Cathode:				
Input	48		58	μμf
Output	1.2		1.5	μμf
Feedback	30		38	μμf

Frequency for Maximum Ratings - - - - - 140 Mc

MECHANICAL

Base	Coaxial
Recommended Socket	Eimac SK-1300
Recommended Chimney	Eimac SK-1306
Operating Position	Vertical, base up or down
Cooling	Forced air
Maximum Operating Temperatures:	
Anode Core	250°C
Ceramic-to-Metal Seals	250°C
Maximum Dimensions:	
Height	8.5 inches
Diameter	7.0 inches
Net Weight	12 pounds

R-F INDUSTRIAL OSCILLATOR
CLASS-C

MAXIMUM RATINGS		
D-C PLATE VOLTAGE	7000 MAX.	VOLTS
D-C PLATE CURRENT	4.0 MAX.	AMPS
PLATE DISSIPATION	10 MAX.	KW
GRID DISSIPATION	250 MAX.	WATTS

TYPICAL OPERATION, Optimum Load

D-C Plate Voltage	6000	7000	volts
D-C Grid Voltage	-575	-670	volts
D-C Plate Current	4.0	4.0	amps
D-C Grid Current	610	670	ma
Plate Input Power	24	28	kw
Plate Output Power	18.9	22.4	kw

R-F POWER AMPLIFIER
GROUNDED-GRID, CLASS-C

MAXIMUM RATINGS		
D-C PLATE VOLTAGE	7000 MAX.	VOLTS
D-C PLATE CURRENT	4.0 MAX.	AMPS
PLATE DISSIPATION	10 MAX.	KW
GRID DISSIPATION	250 MAX.	WATTS

TYPICAL OPERATION

D-C Plate Voltage	6000	7000	volts
D-C Grid Voltage	-535	-625	volts
D-C Plate Current	4.0	4.0	amps
D-C Grid Current	545	530	ma
Driving Power	3700	4100	watts
Plate Output Power	20.5	24.5	kw

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▶ Indicates change from sheet dated 7-1-61

R-F POWER AMPLIFIER
PLATE-MODULATED, CLASS-C

MAXIMUM RATINGS		
D-C PLATE VOLTAGE	5500 MAX.	VOLTS
D-C PLATE CURRENT	3.0 MAX.	AMPS
PLATE DISSIPATION	6.5 MAX.	KW
GRID DISSIPATION	250 MAX.	WATTS

TYPICAL OPERATION

D-C Plate Voltage	4000	5000 volts
D-C Grid Voltage	-480	-600 volts
D-C Plate Current	3.0	3.0 amps
D-C Grid Current	660	550 ma
Driving Power	530	515 watts
Plate Output Power	9.7	12.4 kw

R-F LINEAR AMPLIFIER
GROUNDED-GRID, CLASS-AB2

MAXIMUM RATINGS		
D-C PLATE VOLTAGE	7000 MAX.	VOLTS
D-C PLATE CURRENT	5.0 MAX.	AMPS
PLATE DISSIPATION	12 MAX.	KW
GRID DISSIPATION	250 MAX.	WATTS

TYPICAL OPERATION

D-C Plate Voltage	6000	7000 volts
Zero-Sig Grid Voltage*	-270	-325 volts
Max-Sig D-C Plate Current	4.0	4.0 amps
Max-Sig D-C Grid Current	300	250 ma
Driving Power	1900	2050 watts
Plate Output Power	18	20 kw

*Adjust to give 500 milliamperes zero-signal d-c plate current.

Note: "TYPICAL OPERATION" data are obtained by caluclation from published characteristics curves and confirmed by direct tests. No allowance for circuit losses, either input or output, has been made.

APPLICATION

Cooling - The maximum temperature rating for the external surfaces of the 3CX10,000A3 is 250°C. Sufficient forced-air cooling must be provided to keep the temperature of the anode core and the temperature of the ceramic-metal seals below 250°C. Tube life is usually prolonged if these areas are maintained at temperatures below this maximum rating. Minimum air-flow requirements to maintain anode-core and seal temperatures below 225°C with an inlet-air temperature of 50°C are tabulated. The use of these air-flow rates through the recommended socket/chimney and tube combination in the base-to-anode direction provides effective cooling of the tube.

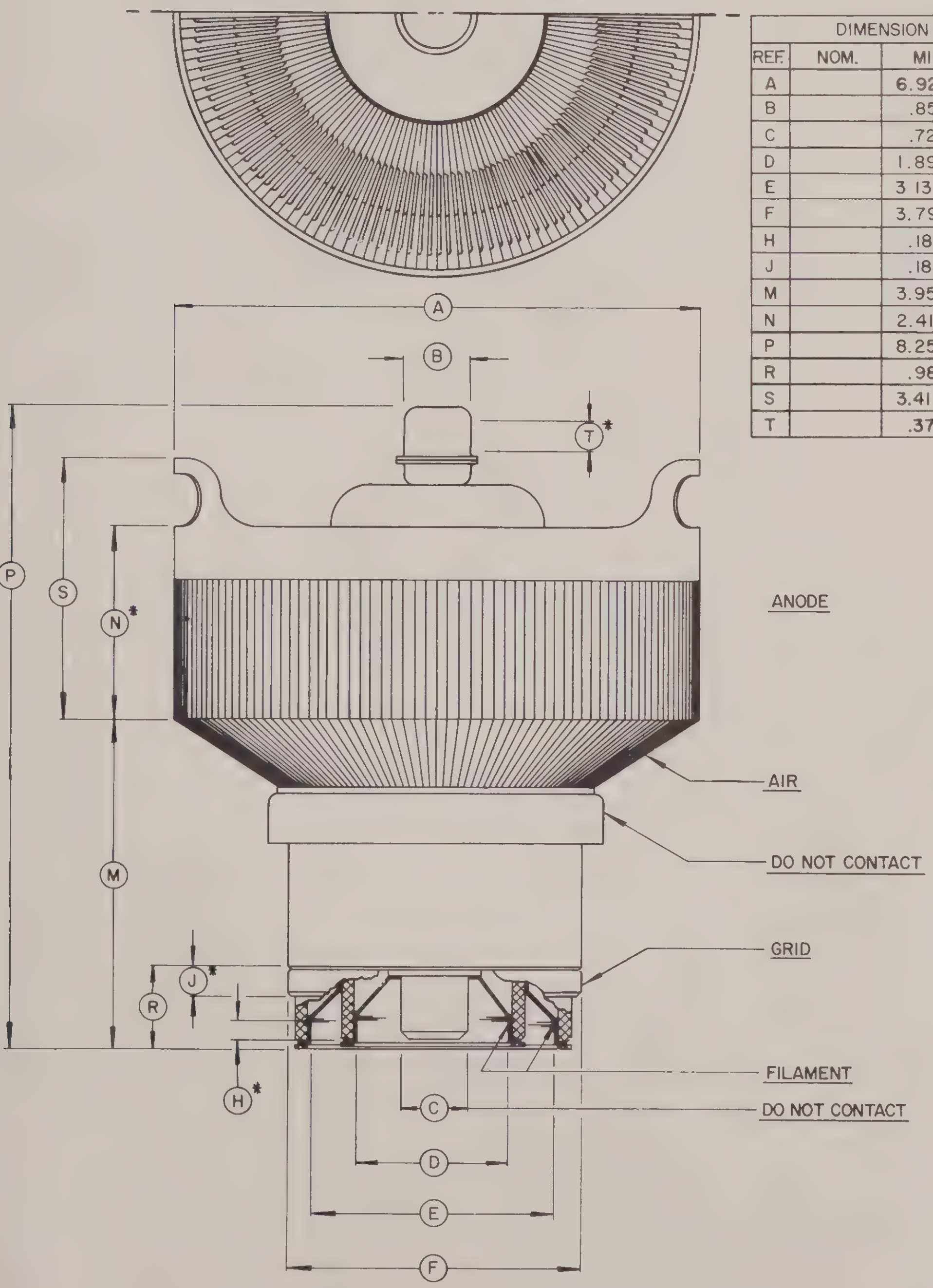
	Sea Level		10,000 Feet	
Plate** Dissipation (Watts)	Air Flow (CFM)	Pressure Drop (Inches of Water)	Air Flow (CFM)	Pressure Drop (Inches of Water)
4000	85	0.18	125	0.25
6000	145	0.38	210	0.55
8000	215	0.68	315	0.99
10,000	295	1.08	430	1.60
12,000	390	1.62	565	2.35

**Since the power dissipated by the filament is about 750 watts and since grid dissipation can, under some circumstances, represent another 250 watts, allowance has been made in preparing this tabulation for an additional 1000 watts dissipation.

Filament Operation - The rated filament voltage for the 3CX10,000A3 is 7.5 volts. Filament voltage, as measured at the socket, should be maintained at this value to obtain maximum tube life. In no case should it be allowed to deviate from the rated value by more than five percent.

Special Applications - If it is desired to operate this tube under conditions widely different from those given here, write to Power Grid Tube Marketing, Eitel-McCullough, Inc., 301 Industrial Way, San Carlos, California, for information and recommendations.

DIMENSION DATA			
REF.	NOM.	MIN.	MAX.
A		6.928	7.050
B		.855	.895
C		.720	.760
D		1.896	1.936
E		3 133	3.173
F		3.792	3.832
H		.188	
J		.188	
M		3.950	4.300
N		2.412	2.788
P		8.250	8.750
R		.986	1.050
S		3.412	3.788
T		.375	



*CONTACT SURFACE
ALL DIMENSIONS IN INCHES

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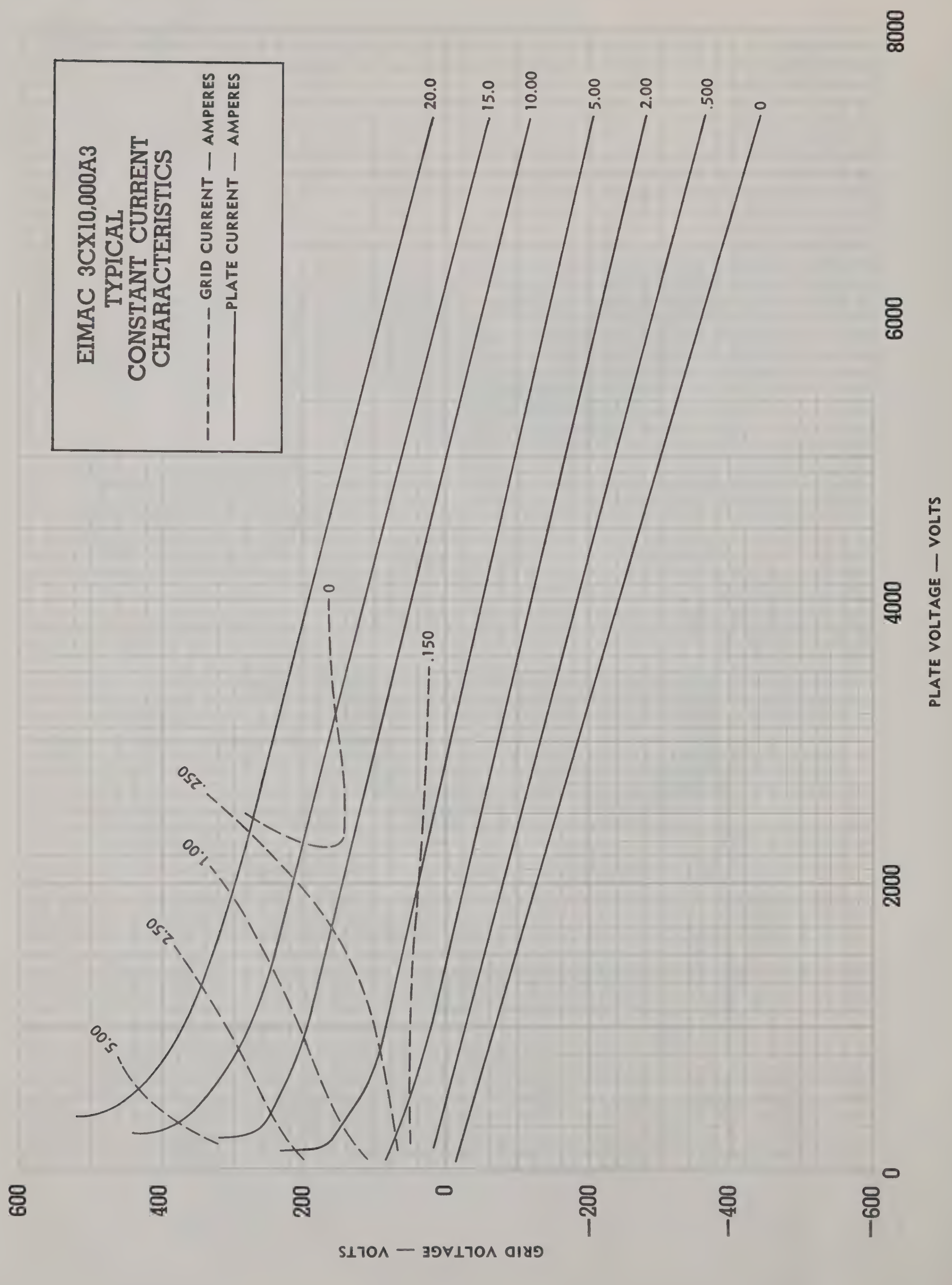
EIMAC 3CX10,000A3
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
- - - - - GRID CURRENT — AMPERES
——— PLATE CURRENT — AMPERES
20.0
15.0
10.00
5.00
2.00
.500
0
5.00
2.50
1.00
.250
0
.150
600
400
200
0
−200
−400
−600
GRID VOLTAGE — VOLTS
0
2000
4000
6000
8000
PLATE VOLTAGE — VOLTS

Eimac®

EITEL-McCULLOUGH, INC.
SAN CARLOS, CALIFORNIA

8160
3CX10,000A7

HIGH-MU POWER TRIODE

The Eimac 8160/3CX10,000A7 is a ceramic and metal power triode intended to be used as a zero-bias Class-B amplifier in audio or radio-frequency applications. Operation with zero grid bias offers circuit simplicity by eliminating the bias supply. In addition, grounded-grid operation is attractive since a power gain as high as twenty times can be obtained with the 8160/3CX10,000A7.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated-Tungsten	Min.	Nom.	Max.	
Voltage	-	7.5		volts
Current	94		104	amperes
Amplification Factor	-	20		

Direct Interelectrode Capacitances:	Min.	Nom.	Max.
Grid-Filament	50.0		62.0 uuf
Grid-Plate	32.0		40.0 uuf
Plate-Filament	-	-	0.3 uuf
▶ Frequency for Maximum Ratings	-	-	160 Mc.

MECHANICAL

Base	Coaxial
Recommended Socket	Eimac SK-1300
Operating Position	Vertical, base up or down
Cooling	Forced air
Maximum Operating Temperatures:	
Anode Core	250° C
Ceramic-to-Metal Seals	250° C
▶ Maximum Dimensions:	
Height	8.75 inches
Diameter	7.05 inches
Net Weight	12 pounds

R-F LINEAR AMPLIFIER
GROUNDED-GRID, CLASS B

MAXIMUM RATINGS		
D-C PLATE VOLTAGE	7000 MAX.	VOLTS
D-C PLATE CURRENT	5.0 MAX.	AMPS
PLATE DISSIPATION	12 MAX.	KW
GRID DISSIPATION	500 MAX.	WATTS

TYPICAL OPERATION, Single-Tone Conditions

D-C Plate Voltage	7000	7000 volts
Zero-Sig D-C Plate Current*	0.60	0.60 amp
Max-Sig D-C Plate Current	3.72	5.00 amps
Max-Sig D-C Grid Current	0.71	1.00 amp
Driving Impedance	35	32 ohms
Resonant Load Impedance	1020	745 ohms
Max-Sig Driving Power	885	1540 watts
Peak Envelope Plate Output Power	17,700	24,200 watts
Power Gain	20.0	15.7 times

*Approximate Values

▶ Indicates change from sheet dated 6-15-61.

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AUDIO-FREQUENCY AMPLIFIER OR MODULATOR - CLASS B, GRID DRIVEN

MAXIMUM RATINGS (Per Tube)		
D-C PLATE VOLTAGE	7000 MAX.	VOLTS
D-C PLATE CURRENT	5.0 MAX.	AMPS
PLATE DISSIPATION	12 MAX.	KW
GRID DISSIPATION	500 MAX.	WATTS

TYPICAL OPERATION, Two Tubes, Sinusoidal Wave

D-C Plate Voltage	7000	7000 volts
D-C Grid Voltage	0	0 volts
Zero-Sig D-C Plate Current*	1.20	1.20 amps
Max-Sig D-C Plate Current	7.50	10.0 amps
Max-Sig D-C Grid Current	1.50	2.06 amps
Driving Power	315	560 watts
Peak A-F Driving Voltage (Per Tube)	250	310 volts
Load Resistance, Plate-to-Plate	2000	1520 ohms
Max-Sig Plate Output Power	35,600	47,700 watts

R-F LINEAR AMPLIFIER CARRIER CONDITIONS, GROUNDED-GRID

MAXIMUM RATINGS		
D-C PLATE VOLTAGE	7000 MAX.	VOLTS
D-C PLATE CURRENT	5.0 MAX.	AMPS
PLATE DISSIPATION	12 MAX.	KW
GRID DISSIPATION	500 MAX.	WATTS

TYPICAL OPERATION

D-C Plate Voltage	7000 volts
D-C Grid Voltage	0 volts
Zero-Sig D-C Plate Current*	0.60 amp
D-C Plate Current	2.40 amps
D-C Grid Current	0.25 amp
Driving Impedance†	32 ohms
Peak Driving Voltage†	310 volts
Driving Power	330 watts
Plate Output Power	5650 watts

R-F POWER AMPLIFIER OR OSCILLATOR, CLASS C

MAXIMUM RATINGS		
D-C PLATE VOLTAGE	7000 MAX.	VOLTS
D-C PLATE CURRENT	4.0 MAX.	AMPS
PLATE DISSIPATION	10 MAX.	KW
GRID DISSIPATION	500 MAX.	WATTS

TYPICAL OPERATION

D-C Plate Voltage	7000 volts
D-C Plate Current	4.0 amps
D-C Grid Voltage	-230 volts
D-C Grid Current	775 ma
Peak R-F Grid Voltage	555 volts
Grid Driving Power	430 watts
Plate Output Power	21.3 kw

PLATE-MODULATED R-F POWER AMPLIFIER

MAXIMUM RATINGS		
D-C PLATE VOLTAGE	5500 MAX.	VOLTS
D-C PLATE CURRENT	3.0 MAX.	AMPS
PLATE DISSIPATION	6.5 MAX.	KW
GRID DISSIPATION	500 MAX.	WATTS

TYPICAL OPERATION

D-C Plate Voltage	5000 volts
D-C Plate Current	3.0 amps
D-C Grid Voltage	-200 volts
D-C Grid Current	775 ma
Peak R-F Grid Voltage	490 volts
Grid Driving Power	380 watts
Plate Output Power	11.9 kw

*Approximate Values
†Modulation Crest Conditions

Note: "TYPICAL OPERATION" data are obtained by calculation from published characteristic curves and confirmed by direct tests. No allowance for circuit losses, either input or output, has been made.

APPLICATION

Mounting— The 3CX10, 000A7 must be operated vertically base up or base down. The tube must be protected from severe vibration and shock.

Cooling— The maximum temperature rating for the external surfaces of the 3CX10, 000A7 is 250°C. Sufficient forced-air cooling must be provided to keep the temperature of the anode core and the temperature of the ceramic-metal seals below 250°C. Tube life is usually prolonged if these areas are maintained at temperatures below this maximum rating. Minimum air-flow requirements to maintain anode-core and seal temperatures below 225°C with an inlet-air temperature of 50°C are tabulated below. The use of these air-flow rates through the recommended socket/chimney and tube combination in the base-to-anode direction provides effective cooling of the tube.

	Sea Level		10, 000 Feet	
Plate** Dissipation (Watts)	Air Flow (CFM)	Pressure Drop (Inches of Water)	Air Flow (CFM)	Pressure Drop (Inches of Water)
4000	85	0.18	125	0.25
6000	145	0.38	210	0.55
8000	215	0.68	315	0.99
10,000	295	1.08	430	1.60
12,000	390	1.62	565	2.35

**Since the power dissipated by the filament is about 750 watts and since grid dissipation can, under some circumstances, represent another 500 watts, allowance has been made in preparing this tabulation for an additional 1250 watts dissipation.

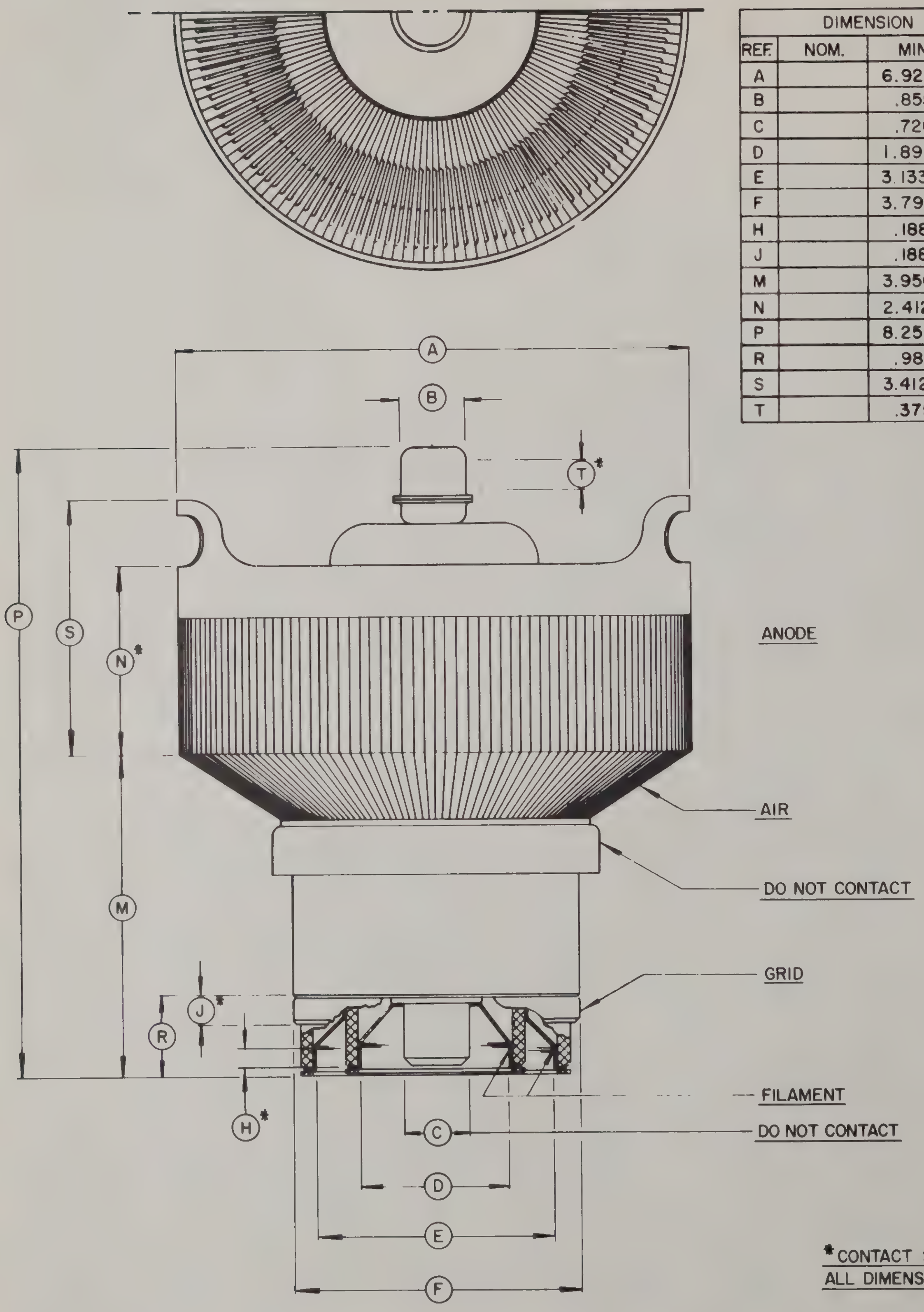
Input Circuit— When the 3CX10, 000A7 is operated as a grounded-grid r-f amplifier, the use of a resonant tank in the cathode circuit is recommended in order to obtain greatest linearity and power output. For best results with a single-ended amplifier it is suggested that the cathode tank circuit operate at a "Q" of two or more.

Class-C Operation— Although specifically designed for class-B service, the 3CX10, 000A7 may be operated as a class-C power amplifier or oscillator or as a plate-modulated radio-frequency power amplifier. The zero-bias characteristic of the 3CX10, 000A7 can be used to advantage in class-C amplifiers by employing only grid-leak bias. If driving power fails plate dissipation is then kept to a low value because the tube will be operating at the normal static zero-bias conditions.

Filament Operation— The rated filament voltage for the 3CX10, 000A7 is 7.5 volts. Filament voltage, as measured at the socket, should be maintained at this value to obtain maximum tube life. In no case should it be allowed to deviate from the rated value by more than plus or minus five percent.

Special Applications— If it is desired to operate this tube under conditions widely different from those given here, write to Power Grid Tube Marketing, Eitel-McCullough, Inc., 301 Industrial Way, San Carlos, California, for information and recommendations.

DIMENSION DATA			
REF.	NOM.	MIN.	MAX.
A		6.928	7.050
B		.855	.895
C		.720	.760
D		1.896	1.936
E		3.133	3.173
F		3.792	3.832
H		.188	
J		.188	
M		3.950	4.300
N		2.412	2.788
P		8.250	8.750
R		.986	1.050
S		3.412	3.788
T		.375	



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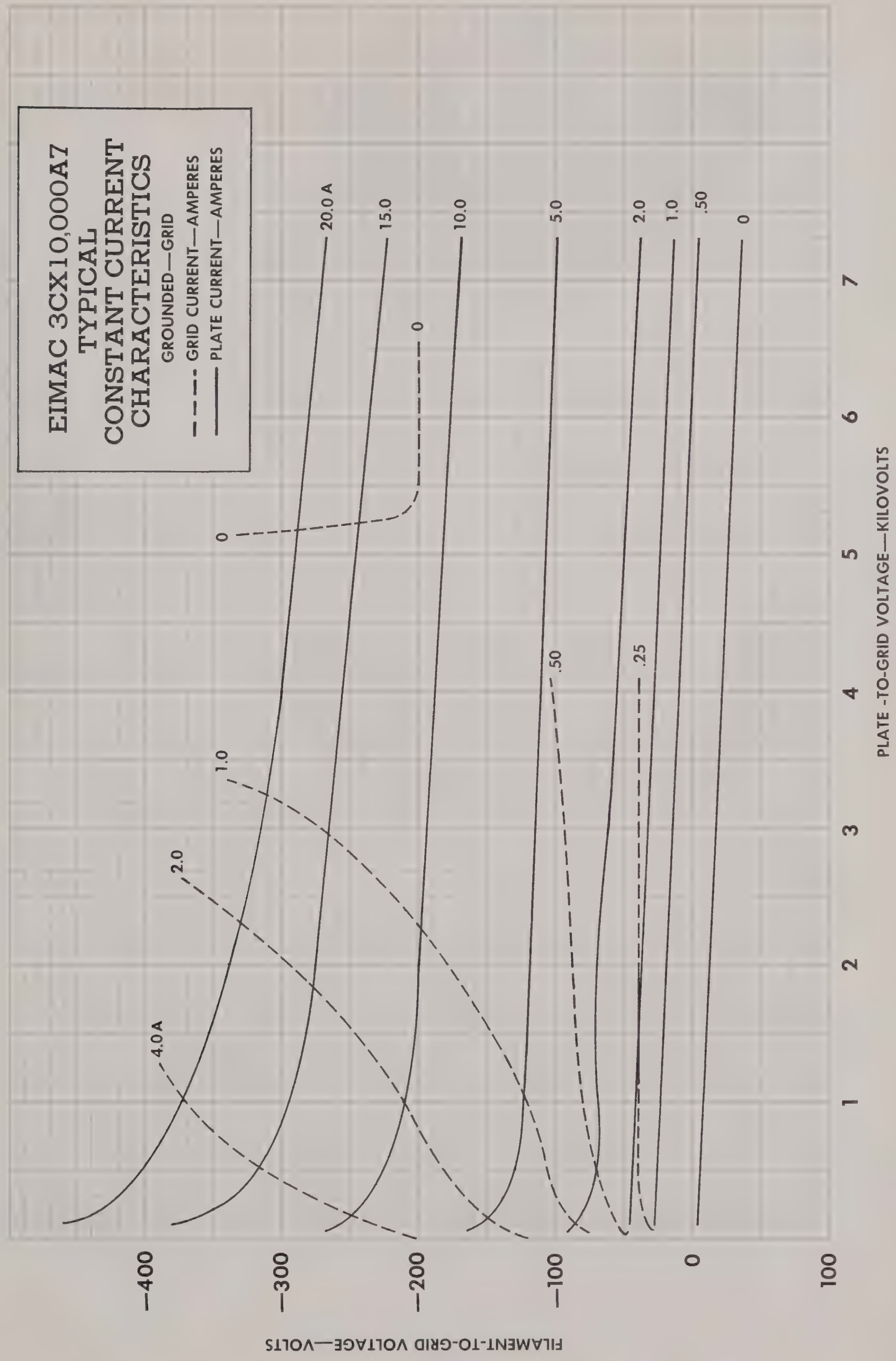
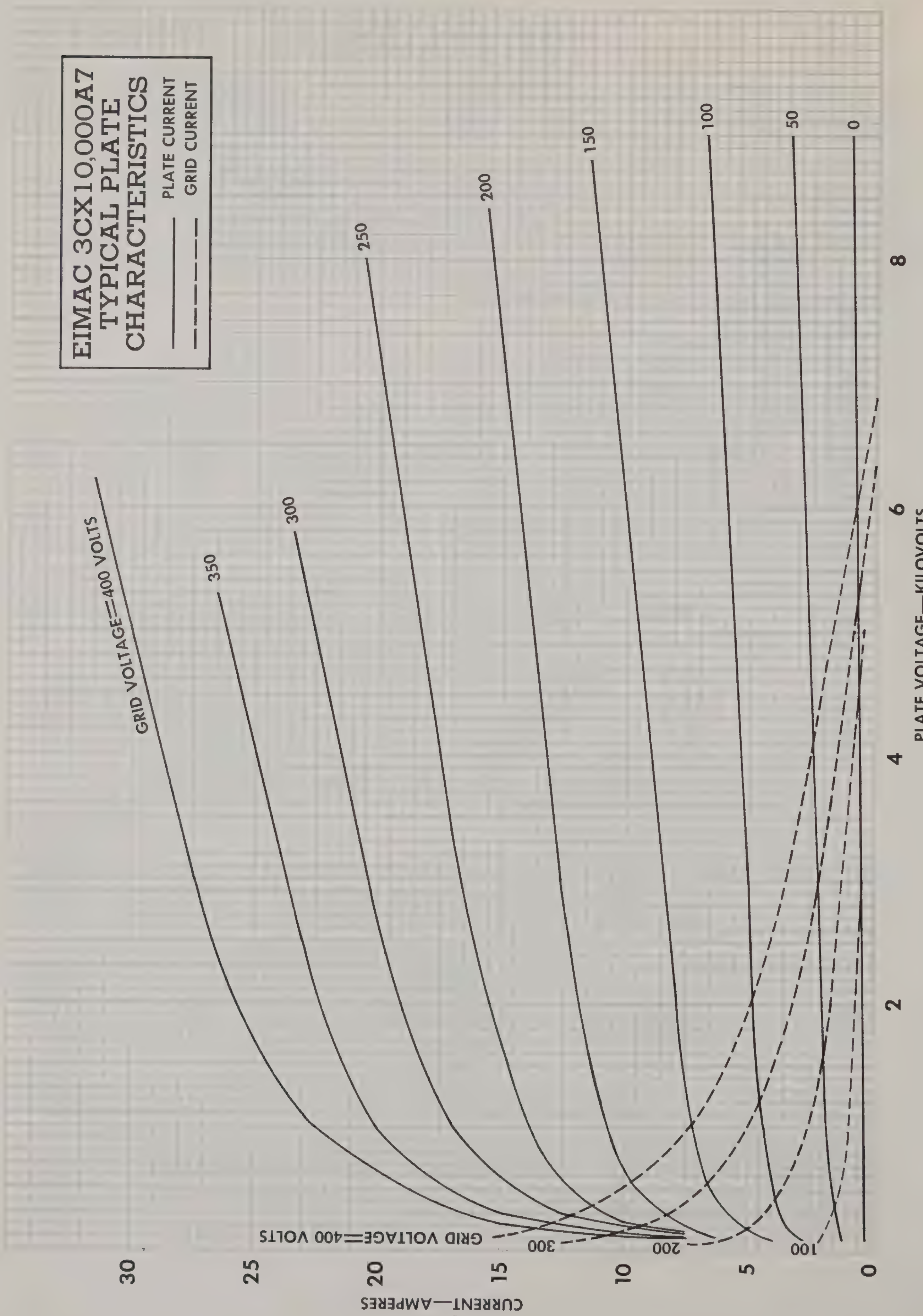


EIMAC 3CX10,000A7 TYPICAL CONSTANT CURRENT CHARACTERISTICS


EIMAC 3CX10,000A7
TYPICAL PLATE
CHARACTERISTICS
PLATE CURRENT
GRID CURRENT
GRID VOLTAGE=400 VOLTS
350
300
250
200
150
100
50
0
GRID VOLTAGE=400 VOLTS
300
200
100
CURRENT—AMPERES
0
5
10
15
20
25
30
PLATE VOLTAGE—KILOVOLTS
2
4
6
8

TECHNICAL DATA

8240
3CW5000A1
8241
3CW5000F1

LOW-MU WATER-COOLED TRIODES

The EIMAC 8240/3CW5000A1 and 8241/3CW5000F1 are low-mu water-cooled power triodes intended for use as audio amplifiers or modulators. Their maximum rated plate dissipation is 5000 watts. The two types are identical except for the addition of flexible leads for the grid and filament terminals on the 8241/3CW5000F1.

Two of these tubes, in Class AB_1 audio service, will deliver more than 10 kilowatts maximum-signal plate output power at 6000 plate volts without drawing grid current.

These two types are electrically identical to the air-cooled EIMAC 8238/3CX3000A1 except for the plate dissipation rating.

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Filament: Thoriated Tungsten	
Voltage	7.5 ± 0.37 V
Current, at 7.5 volts	
8240/3CW5000A1	51.5 A
8241/3CW5000F1	50.5 A
Transconductance (Average)	
$I_b = 1.0$ Adc, $E_b = 3000$ Vdc	11,000 μmhos
Amplification Factor (Average)	4.9

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[1] Characterisitcs and operating values are based on performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Div. of Varian should be consulted before using this information for final equipment design.

MECHANICAL

Maximum Overall Dimensions:	
Length (excluding leads on 8241/3CW5000F1)	12.625 in; 321 mm
Diameter	3.255 in; 86.2 mm
Net Weight (Approximate)	3.5 lbs; 1.6 kg
Operating Position	Axis vertical, base down or up
Maximum Operating Temperature:	
Ceramic/Metal Seals or Envelope	250°C
Cooling:	
Seals and Envelope	Forced Air
Plate	Water
Base	See Outline Drawings

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AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR

Class AB_1, Grid Driven (Sinusoidal Wave)

ABSOLUTE MAXIMUM RATINGS (per tube)

DC PLATE VOLTAGE	6000	VOLTS
DC PLATE CURRENT	2.5	AMPERES
PLATE DISSIPATION	5000	WATTS
GRID DISSIPATION	50	WATTS

TYPICAL OPERATION (Class AB_1, Sinusoidal Wave, Two Tubes)

Plate Voltage	4000	5000	6000	Vdc
Grid Voltage[1]	-860	-1080	-1300	Vdc
Zero-Signal Plate Current	500	400	335	mAdc
Max. Signal Plate Current	3.00	2.80	2.65	Adc
Peak af Grid Voltage[2]	760	995	1250	v
Peak Driving Power	0	0	0	w
Max. Signal Plate Input Power	12,000	14,000	16,000	W
Max. Signal Plate Dissipation[2]	3000	3000	3000	W
Max. Signal Plate Output Power	6000	8000	10,000	W
Load Resistance (plate to plate)	2160	3320	4560	Ω

1. Approximate value; adjust to give stated zero-signal plate current.
2. Per tube.

NOTE: TYPICAL OPERATION data are obtained by measurement or calculation from published characteristic curves. Adjustment of the grid voltage to obtain the specified plate current at the specified bias, and plate voltages is assumed. If this procedure is followed, there will be little variation in output power when the tube is changed.

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.	
Filament: Current at 7.5 volts (8240/3CW5000A1)	49.0	54.0	A
(8241/3CW5000F1)	48.0	53.0	A
Amplification Factor	4.3	5.6	

APPLICATION

MECHANICAL

MOUNTING - The 3CW5000A1 and 3CW5000F1 must be mounted vertically, base down or up at the convenience of the circuit designer. The filament connections to the 3CW5000A1 should be made through spring collets. These are available from EIMAC with the following part numbers:

149575	Inner line collet;
149576	Outer line collet

Reasonable care should be taken that these collets do not impart undue strain to the terminals or the base of the tube.

COOLING - With an anode dissipation of 5000 watts and with an incoming water temperature of 50°C maximum, 7.7 gpm of cooling water must be supplied to the anode cooling jacket. Outlet water temperature from the cooling jacket should never exceed 70°C, and water pressure on the jacket should not exceed 60 psi. The pressure drop across the anode cooling jacket itself, with a water flow of 7.7 gpm, will be approximately 6 psi.

The grid-terminal contact surface and adjacent ceramic must be cooled by forced air, with quantity, velocity, and direction adjusted to limit the maximum seal temperature to less than 250°C.

The filament stem structure also requires forced-air cooling. A minimum of 6 cfm should be directed into the space between the inner and outer filament contacting surfaces.

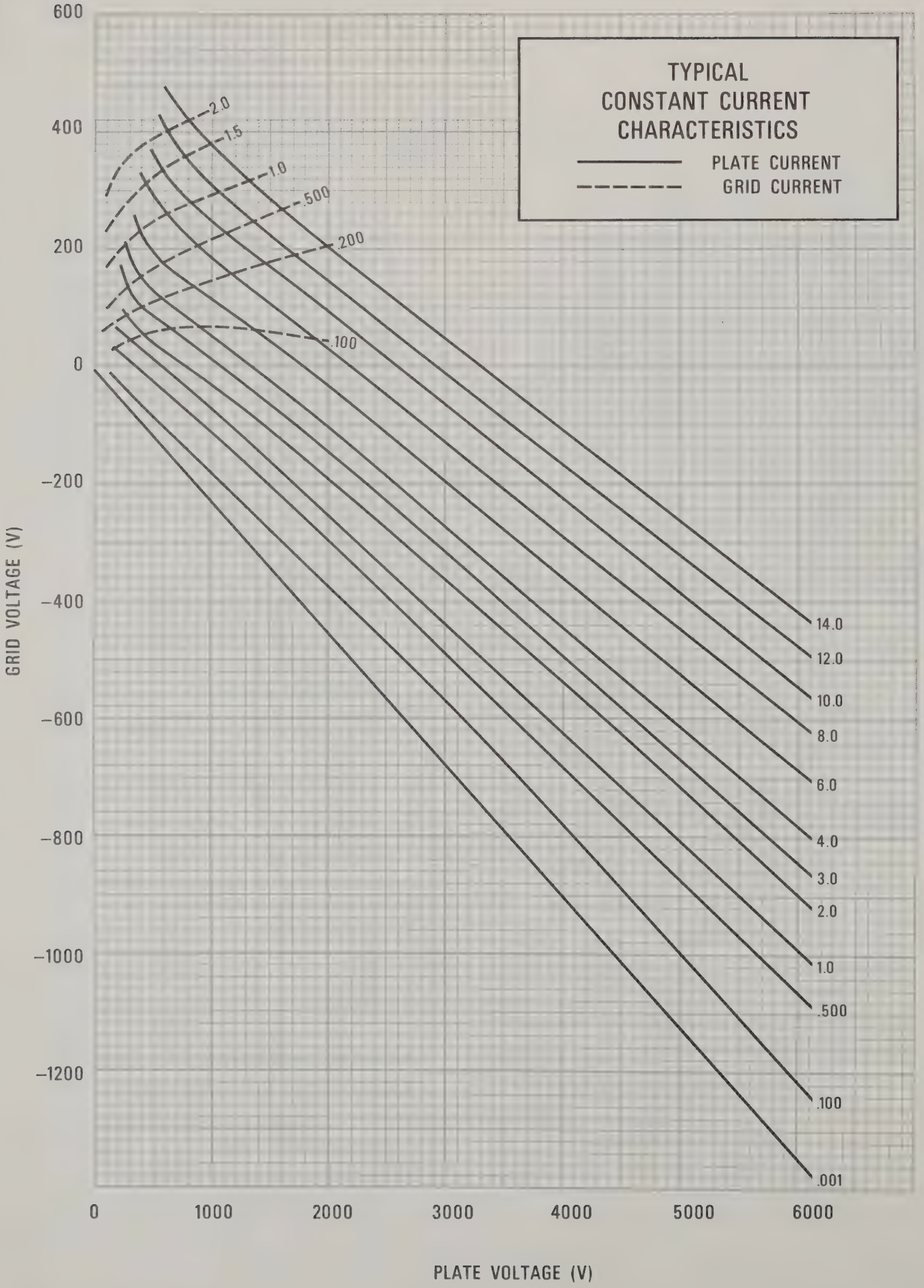
Both air and water flow must be supplied before or simultaneously with the application of electrode voltages, including the filament, and may be removed simultaneously with them. Where long life and consistent performance are factors, cooling in excess of minimum requirements is normally beneficial.

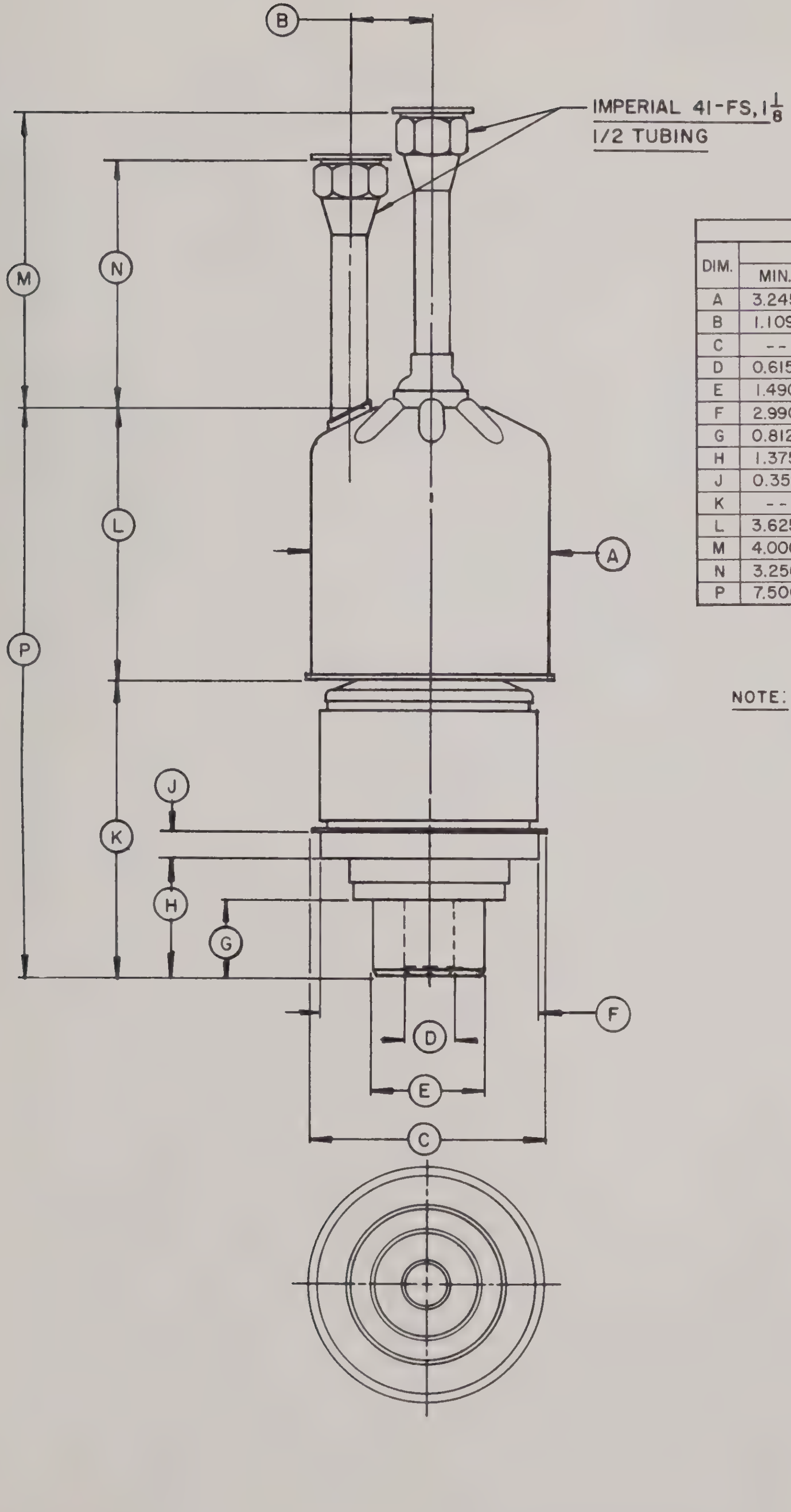
ELECTRICAL

FILAMENT OPERATION - The filament voltage, as measured at the filament terminals, should be 7.5 volts, with maximum allowable variations due to line fluctuations of from 7.12 to 7.87 volts.

HIGH VOLTAGE - The 3CW5000A1 and 3CW-5000F1 operate at voltages which can be deadly, and the equipment must be designed properly and operating precautions must be followed. Equipment must be designed so that no one can come in contact with high voltages. All equipment must include safety enclosures for high-voltage circuits and terminals, with interlock switches to open the primary circuits of the power supplies and to discharge high-voltage condensers when access doors are opened. Interlock switches must not be bypassed or "cheated" to allow operation with access doors open. Always remember that HIGH VOLTAGE CAN KILL.

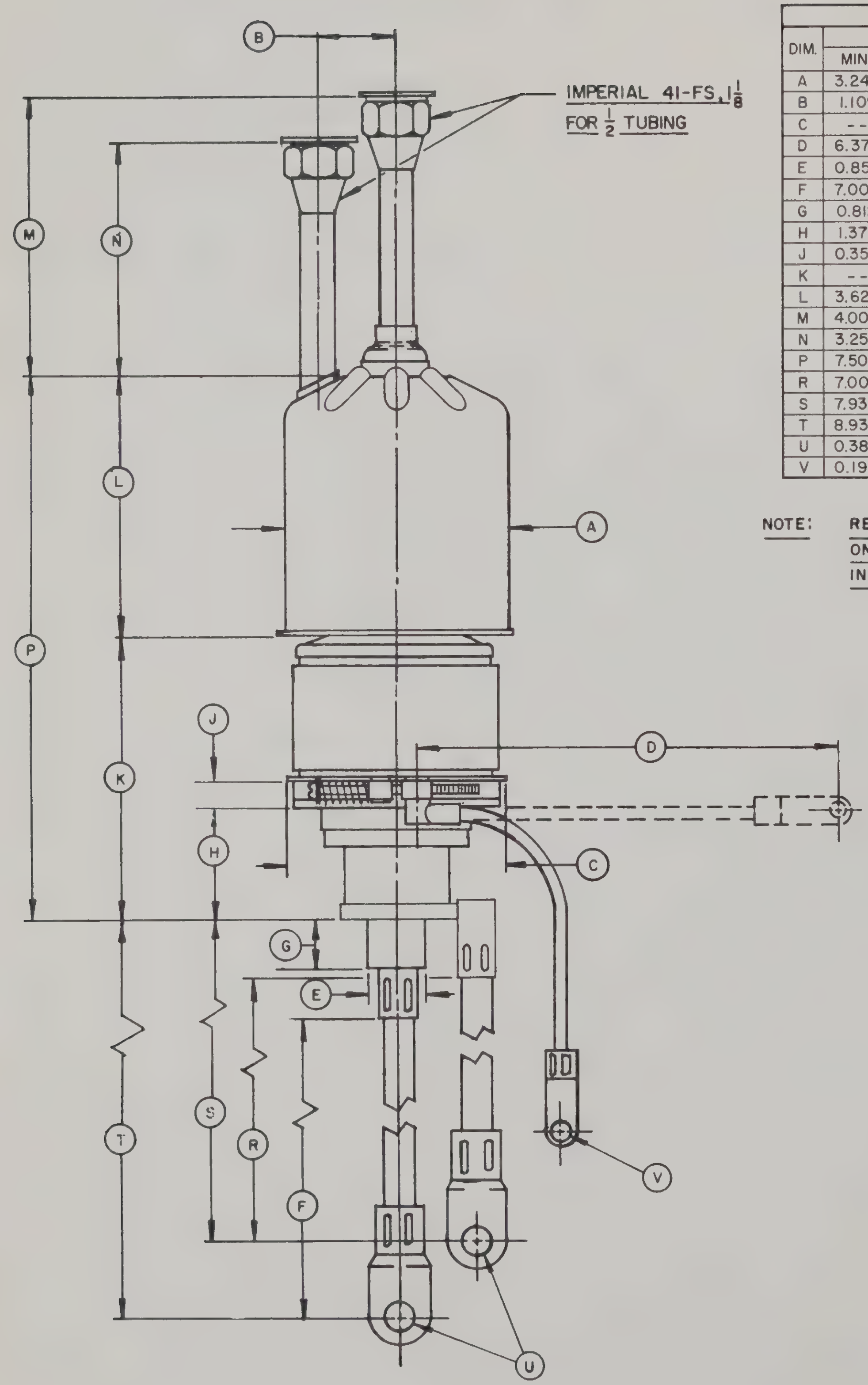
SPECIAL APPLICATIONS - If it is desired to operate these tubes under conditions widely different from those given here write to the Power Grid Tube Division, EIMAC Division of Varian, 301 Industrial Way, San Carlos, CA. 94070, for information and recommendations.


TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
PLATE CURRENT
GRID CURRENT
600
400
200
0
−200
−400
−600
−800
−1000
−1200
GRID VOLTAGE (V)
0
1000
2000
3000
4000
5000
6000
PLATE VOLTAGE (V)
2.0
1.5
1.0
.500
.200
.100
14.0
12.0
10.0
8.0
6.0
4.0
3.0
2.0
1.0
.500
.100
.001



DIMENSIONAL DATA						
DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	3.245	3.255	--	82.42	82.68	--
B	1.109	1.141	--	28.17	28.98	--
C	--	3.625	--	--	92.08	--
D	0.615	0.635	--	15.62	16.13	--
E	1.490	1.510	--	37.85	38.35	--
F	2.990	3.010	--	75.95	76.45	--
G	0.812	0.938	--	20.62	23.83	--
H	1.375	1.625	--	34.93	41.28	--
J	0.359	0.422	--	9.12	10.72	--
K	--	--	3.599	--	--	91.41
L	3.625	3.875	--	92.08	98.43	--
M	4.000	4.500	--	101.60	114.30	--
N	3.250	3.750	--	82.55	95.25	--
P	7.500	8.125	--	190.50	206.38	--

NOTE: REF. DIMS ARE FOR INFO ONLY AND NOT REQ. FOR INSPECTION PURPOSES.



DIMENSIONAL DATA						
DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	3.245	3.255	- -	82.42	82.68	- -
B	1.109	1.141	- -	28.17	28.98	- -
C	- -	3.625	- -	- -	92.08	- -
D	6.375	6.625	- -	161.93	168.28	- -
E	0.859	0.890	- -	21.82	22.61	- -
F	7.000	7.500	- -	177.80	190.50	- -
G	0.812	0.938	- -	20.62	23.83	- -
H	1.375	1.625	- -	34.93	41.28	- -
J	0.359	0.422	- -	9.12	10.72	- -
K	- -	- -	3.599	- -	- -	91.41
L	3.625	3.875	- -	92.08	98.43	- -
M	4.000	4.500	- -	101.60	114.30	- -
N	3.250	3.750	- -	82.55	95.25	- -
P	7.500	8.125	- -	190.50	206.38	- -
R	7.000	7.500	- -	177.80	190.50	- -
S	7.937	8.437	- -	201.60	214.30	- -
T	8.937	9.437	- -	226.99	239.70	- -
U	0.385	0.395	- -	9.78	10.03	- -
V	0.194	0.200	- -	4.93	5.08	- -

NOTE: REF. DIMS ARE FOR INFO ONLY AND NOT REQ. FOR INSPECTION PURPOSES.

Eimac®

EITEL-McCULLOUGH, INC.
[illegible]

8243
3W5000F3

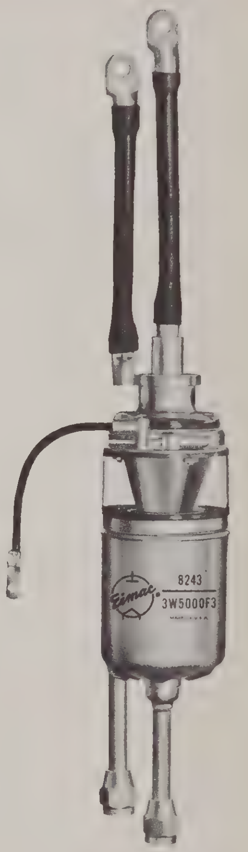
MEDIUM-MU POWER TRIODE

The Eimac 8243/3W5000F3 is a water-cooled, medium-mu power triode intended for amplifier, oscillator or modulator service. It has a maximum plate dissipation rating of 5000 watts and is capable of high output at relatively low plate voltages. A single 3W5000F3 will deliver a radio frequency plate power-output of 7500 watts at a plate voltage of 4000 volts.

The tube is equipped with flexible filament and grid leads which simplifies socketing and equipment design for industrial and communication frequencies below 30 Mc.

NOTE: The 8243/3W5000F3 is a water-cooled version of the air-cooled 8251/3X2500F3.

The 8243/3W5000F3 should be used where water cooling is preferred and for industrial applications or installations where reserve anode dissipation is desired.



GENERAL CHARACTERISTICS

ELECTRICAL

	Min.	Nom.	Max.	
Filament: Thoriated tungsten				
Voltage		7.5		volts
Current	49		54	amperes
Maximum allowable starting current			100	amperes
Amplification Factor (Average)		20		
Direct Interelectrode Capacitances (Average)				
Grid-Plate	17.8		24.2	μμf
Grid-Filament	29.2		40.2	μμf
Plate-Filament	0.60		1.20	μμf
Transconductance (I_b=830 ma, E_b=3000v)		20,000		μmhos
Frequency for Maximum Ratings			30	mc

MECHANICAL

Base	see drawing
Mounting	vertical, base down or up
Maximum Over-All Dimensions:	
Length (Does not include filament connectors)	12.56 inches
Diameter	3.63 inches
Net Weight	4.8 pounds
Shipping Weight (Average)	15 pounds
Cooling	Water and forced air

RADIO FREQUENCY POWER AMPLIFIER OR OSCILLATOR

(Frequencies below 30 Mc.)
Class-C FM or Telegraphy
(Key-down conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	6000 MAX. VOLTS
D-C PLATE CURRENT	2.5 MAX. AMPS
PLATE DISSIPATION	5000 MAX. WATTS
GRID DISSIPATION	150 MAX. WATTS

TYPICAL OPERATION
(Frequencies below 30 Mc., per tube)

D C Plate Voltage	4000	5000	6000	volts
D-C Plate Current	2.5	2.5	2.08	amps
D-C Grid Voltage	—300	—450	—500	volts
D-C Grid Current	245	265	180	ma
Peak R-F Grid Input Voltage	580	750	765	volts
Driving Power (approx.)	142	197	136	watts
Grid Dissipation	68	78	46	watts
Plate Power Input	10,000	12,500	12,500	watts
Plate Dissipation	2500	2500	2500	watts
Plate Power Output	7500	10,000	10,000	watts

PLATE MODULATED RADIO FREQUENCY AMPLIFIER

(Frequencies below 30 Mc.)
Class-C Telephony
(Carrier conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	5000 MAX. VOLTS
D-C PLATE CURRENT	2.0 MAX. AMPS
PLATE DISSIPATION	3350 MAX. WATTS
GRID DISSIPATION	150 MAX. WATTS

TYPICAL OPERATION
(Frequencies below 30 Mc., per tube)

D C Plate Voltage	4000	4500	5000	volts
D-C Plate Current	1.67	1.55	1.45	amps
Total Bias Voltage	—450	—500	—550	volts
Fixed Bias Voltage	—230	—325	—410	volts
Grid Resistor	1500	1500	1400	ohms
D-C Grid Current	150	120	100	ma
Peak R-F Grid Input Voltage	680	720	760	volts
Driving Power (approx.)	102	86	76	watts
Grid Dissipation	35	26	21	watts
Plate Power Input	6670	6970	7250	watts
Plate Dissipation	1670	1670	1670	watts
Plate Power Output	5000	5300	5580	watts

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AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class B (Sinusoidal wave, two tubes unless otherwise specified)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	6000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT, PER TUBE	2.5 MAX. AMPS
PLATE DISSIPATION, PER TUBE	5000 MAX. WATTS

TYPICAL OPERATION (Sinusoidal wave, two tubes unless noted)

D-C Plate Voltage	4000	5000	6000	volts
D-C Grid Voltage[1]	—150	—190	—240	volts
Zero-Signal D-C Plate Current	0.6	0.5	0.4	amps
Max-Signal D-C Plate Current	4.0	3.2	3.0	amps
Effective Load, Plate to Plate	2200	3600	4650	ohms
Peak A-F Grid Input Voltage (per tube)*	340	360	390	volts
Max-Signal Peak Driving Power*	340	230	225	watts
Max-Signal Nominal Driving Power*	170	115	113	watts
Max-Signal Plate Output Power	11,000	11,000	13,000	watts

*Approximate values.

[1] Adjust to give listed zero-signal plate current.

TYPICAL OPERATION CLASS AB_2 (Two Tubes)

Modulator service for 4000 and 5000 volt operation, to modulate one or two tubes, as shown under "Plate Modulated Radio Frequency Amplifier" (Page 1)

D-C Plate Voltage	4000	5000	4000	5000	volts
D-C Grid Voltage (approx.)*	—155	—200	—145	—190	volts
Zero-Signal D-C Plate Current	0.4	0.4	0.6	0.5	amps
Max-Signal D-C Plate Current	1.35	1.13	2.70	2.26	amps
Effective Load, Plate to Plate	6600	10,000	3300	5000	ohms
Peak A-F Grid Input Voltage (per tube)	240	275	285	310	volts
Max-Signal Peak Driving Power	42	40	134	118	watts
Max-Signal Nominal Driving Power (approx.)	21	20	67	59	watts
Max-Signal Plate Power Output	3700	4000	7400	8000	watts
Will Modulate one Tube R-F Final Input of	6670	7250			watts
Will Modulate two tubes R-F Final Input of			13,340	14,500	watts

*Adjust to give stated zero-signal plate current.

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER "TYPICAL OPERATION," POSSIBLY EXCEEDING THE MAXIMUM RATINGS GIVEN FOR CW SERVICE, WRITE EITEL-McCULLOUGH, INC., FOR INFORMATON AND RECOMMENDATIONS

APPLICATION

▶ **Cooling—**Minimum recommended water-flow rate and pressure drop values for different water-inlet temperatures and plate dissipations are tabulated on the opposite page. The outlet water temperature must not exceed a maximum of 70° C under any conditions. The inlet water pressure must not exceed a maximum of 60 pounds per square inch.

The grid-terminal contact surface and adjacent glass must be cooled by forced air. The quantity, velocity and direction must be adjusted to limit the maximum seal temperature to 150° C.

The filament stem structure also requires forced-air cooling. A minimum of 6 cubic feet per minute must be directed into the space between the inner and outer filament contacting surfaces.

Air and water flow must be started before filament power is applied and maintained for at least five minutes after the filament power has been removed.

Filament Voltage—The filament voltage, as measured directly at the tube, should be 7.5 volts with maximum allowable variations due to line fluctuation of from 7.12 to 7.87 volts.

Bias Voltage—There is little advantage in using bias voltages in excess of those given under "Typical Operation," except in certain very specialized applications. Where bias is obtained from a grid resistor, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation.

Plate Voltage — The plate supply voltage for the 3W5000F3 should not exceed 6000 volts. In most cases there is little advantage in using plate-supply voltages higher than those given under "Typical Operation" for the power output desired.

In Class-C FM or Telegraphy service, a 0.1 henry choke, shunted by a spark gap, should be series connected between the plates of the amplifier tubes and the high voltage plate supply capacitor to offer protection from transients and surges. In plate modulated service, where a plate modulation transformer is used, the protective choke is not normally required.

Grid Dissipation—The power dissipated by the grid of the 3W5000F3 must never exceed 150 watts. Grid dissipation may be calculated from the following expression

$$P_g = e_{cmp} I_c$$

where P_g = Grid dissipation,

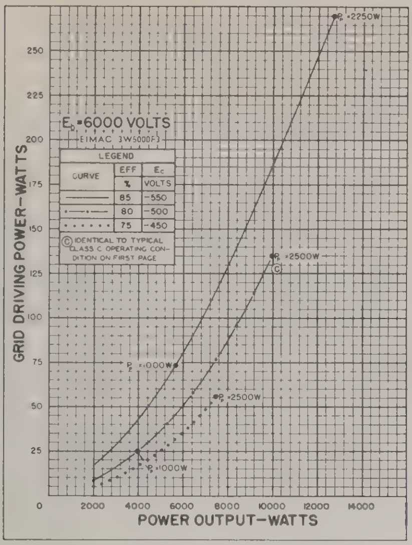
e_{cmp} = Peak positive grid voltage, and

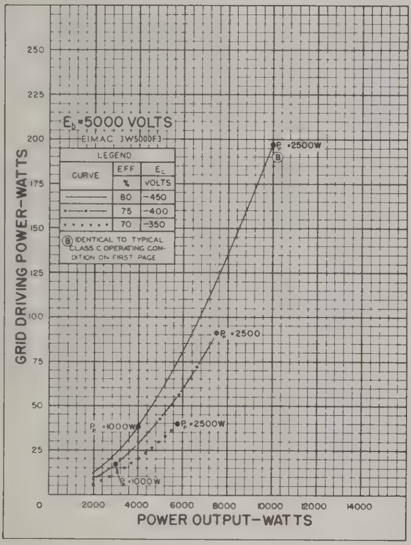
I_c = D-C grid current

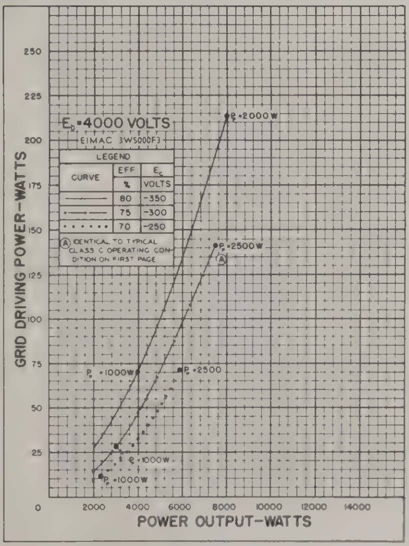
e_{cmp} may be measured by means of a suitable peak voltmeter connected between filament and grid. Any suitable peak v.t.v.m. circuit may be used.

In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading.

▶ Indicates change from sheet dated 8-26-58

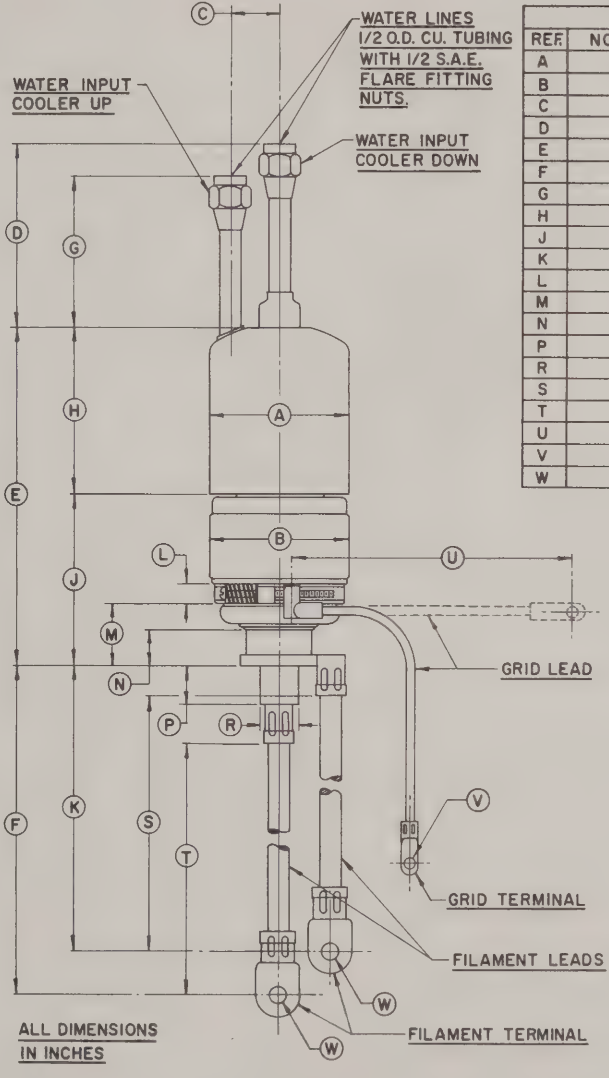






► MINIMUM WATER COOLING REQUIREMENTS

Water Inlet Temp. (°C)	Plate Dissipation							
	2 KW		3 KW		4 KW		5 KW	
	Flow Rate GPM	Pressure Drop PSI	Flow Rate GPM	Pressure Drop PSI	Flow Rate GPM	Pressure Drop PSI	Flow Rate GPM	Pressure Drop PSI
20	1.7	0.68	2.6	1.3	3.9	2.3	5.6	3.9
30	2.3	1.1	3.2	1.7	4.5	2.8	6.2	4.5
40	3.0	1.6	3.8	2.2	5.3	3.5	6.9	5.3
50	3.9	2.3	4.7	3.0	6.0	4.3	7.7	6.1

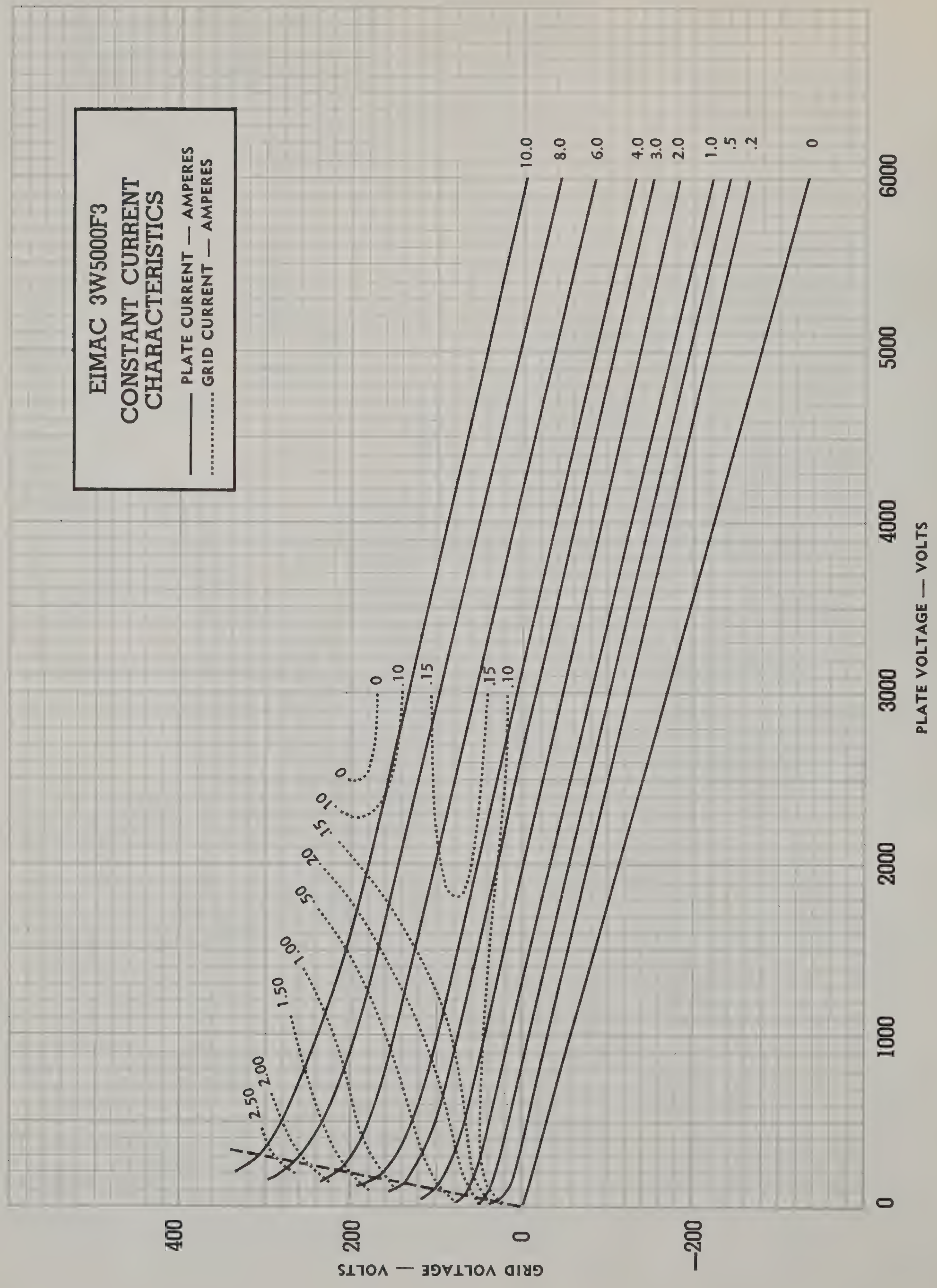


DIMENSION DATA			
REF.	NOM.	MIN.	MAX.
A		3.234	3.266
B			3.625
C		1.062	1.187
D		4.000	4.500
E		7.562	8.062
F		8.937	9.437
G		3.250	3.750
H		3.625	3.875
J		3.937	4.187
K		7.937	8.437
L		.375	.437
M		1.437	1.562
N		.812	.937
P		.812	.937
R		.859	.890
S		7.000	7.500
T		7.000	7.500
U		6.375	6.625
V		.194	.200
W		.385	.395

DRIVING POWER vs. POWER OUTPUT

The three charts on this page show the relationship of plate efficiency, power output and approximate grid driving power at plate voltages of 4000, 5000 and 6000 volts. These charts show combined grid and bias losses only. The driving-power and power-output figures do not include circuit losses. The plate dissipation in watts is indicated by Pp. Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 4000, 5000 and 6000 volts respectively.

► Indicates change from sheet dated 8-26-58

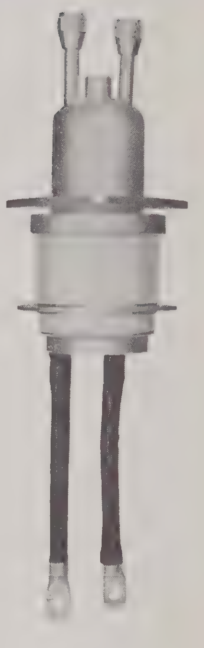

EIMAC 3W5000F3
CONSTANT CURRENT CHARACTERISTICS
—— PLATE CURRENT — AMPERES
.... GRID CURRENT — AMPERES
10.0
8.0
6.0
4.0
3.0
2.0
1.0
.5
.2
0
2.50
2.00
1.50
1.00
.50
.20
.15
.10
0
.15
.10
.15
.10
0
PLATE VOLTAGE — VOLTS
0
1000
2000
3000
4000
5000
6000
GRID VOLTAGE — VOLTS
400
200
0
−200

TECHNICAL DATA

3CW10,000H3

INDUSTRIAL
MEDIUM-MU

WATER-COOLED
POWER TRIODE



The EIMAC 3CW10,000H3 is a water-cooled, ceramic/metal power triode designed primarily for use in industrial radio-frequency heating services. Its water-cooled anode is conservatively rated at 10 kilowatts of plate dissipation with low water flow and pressure drop.

Input of 30 kilowatts is permissible up to 90 Megahertz. Plentiful reserve emission is available from its 560 watt filament. The grid structure is rated at 150 watts making this tube an excellent choice for severe applications.

GENERAL CHARACTERISTICS [1]

ELECTRICAL

Filament: Thoriated Tungsten	
Voltage	7.5 ± 0.37 V
Current, at 7.5 volts	75 A
Amplification Factor (Average):	20
Direct Interelectrode Capacitance (grounded cathode)[2]	
Input	53.0 pF
Output	1.5 pF
Feedback	25.0 pF
Frequency of Maximum Rating:	
C W	90 MHz

---

1. Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.

2. Capacitance values are for a cold tube as measured in a special shielded fixture.

MECHANICAL

Maximum Overall Dimensions:	
Length (excluding leads)	10.450 in; 265.43 mm
Diameter	5.090 in; 129.29 mm
Net Weight	10 lb; 4.54 kg
Operating Position	Vertical, base down or up
Maximum Operating Temperature:	
Ceramic/Metal Seals	250 °C
Cooling	Water and Forced Air
Base	See Outline

(Revised 10-15-70) © 1966, 1970 by Varian Printed in U.S.A.

RADIO FREQUENCY INDUSTRIAL OSCILLATOR
Class C (Filtered DC Power Supply)
(Key-Down Conditions)

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE	10,000	VOLTS
DC GRID VOLTAGE	-1000	VOLTS
DC PLATE CURRENT	3.0	AMPERES
DC GRID CURRENT	0.5	AMPERE
PLATE INPUT POWER	30,000	WATTS
PLATE DISSIPATION	10,000	WATTS

TYPICAL OPERATION (Frequencies to 90 MHz)[2]

Plate Voltage	7000	9000	Vdc
Grid Voltage	-700	-900	Vdc
Plate Current	2.88	2.90	Adc
Grid Current [1]	0.18	0.18	Adc
Peak rf Grid Voltage[1]	250	250	v
Calculated Driving Power	170	215	W
Plate Input Power	20.15	26.10	kW
Plate Dissipation	5.15	5.50	kW
Plate Output Power	15.0	20.6	kW
Resonant Load Impedance	1120	1470	Ω

1. Approximate value.
2. Loaded Conditions

NOTE: TYPICAL OPERATION data are obtained by calculation from published characteristic curves or actual measurment. Adjustment of the rf grid voltage to obtain the specified plate current at the specified bias and plate voltages is assumed. If this procedure is followed, there will be little variation in output power when the tube is changed, even though there may be some variation in grid current. The grid current which results when the desired plate current is obtained is incidental and varies from tube to tube. These current variations cause no difficulty so long as the circuit maintains the correct voltage in the presence of the variations in current. If grid bias is obtained principally by means of a grid resistor, the resistor must be adjustable to obtain the required bias voltage when the correct rf grid voltage is applied.

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.	
Filament: Current at 7.5 volts	72	77	A
Interelectrode Capacitances[1] (grounded filament connection)			
Input	46.0	56.0	pF
Output	1.35	1.65	pF
Feedback	22.0	28.0	pF

1. Capacitance values are for a cold tube as measured in a shielded fixture.

APPLICATION

MECHANICAL

MOUNTING - The 3CW10,000H3 must be mounted vertically, either base up or down. A grid contact flange is provided for bolting to a strap or a grid deck. Heavy flexible leads are provided for applying the filament voltage.

COOLING - Anode cooling is accomplished by circulating water through the integral anode-water jacket.

The table below lists minimum water flow requirement for adequate anode cooling at various plate dissipation levels. In all cases, the outlet water temperature must not exceed 70°C nor should inlet water pressure exceed 60 psi. This table is based upon 15°C temperature rise of water from inlet to outlet.

MINIMUM WATER-COOLING REQUIREMENT		
Plate Dissipation (kW)	Water Flow (gpm)	Pressure Drop (psi)
8	3.2	5.5
10	4.4	8.1
12	5.8	13.4

Additional stem cooling air must be provided. 8 CFM of air directed against the center filament contact ring ½ inch below the outer filament contact ring by a 1½ inch I.D. air duct arranged at a 45° angle with the center line of the tube will provide adequate cooling.

ELECTRICAL

FILAMENT - The rated filament voltage for the 3CW10,000H3 is 7.5 volts. Filament voltage, as measured at the tube, must be maintained at 7.5 volts plus or minus five percent for maximum tube life and consistent performance.

GRID OPERATION - The grid current rating is 0.5 ampere dc. This value should not be exceeded for more than very short periods such as during tuning. Over-current protection in the grid circuit should be provided. Ordinarily it will not be necessary to operate with more than 0.25 ampere grid current to obtain reasonable efficiency. In industrial heating service with varying loads, grid current should be monitored continuously with a dc current meter. The maximum grid dissipation rating is 150 watts.

PLATE OPERATION - Plate over-current protection should be provided to remove plate voltage quickly in the event of an overload or an arc-over at the load. In addition current limiting power supply resistors should be used. These precautions are especially important in industrial service with its wide variations in loading.

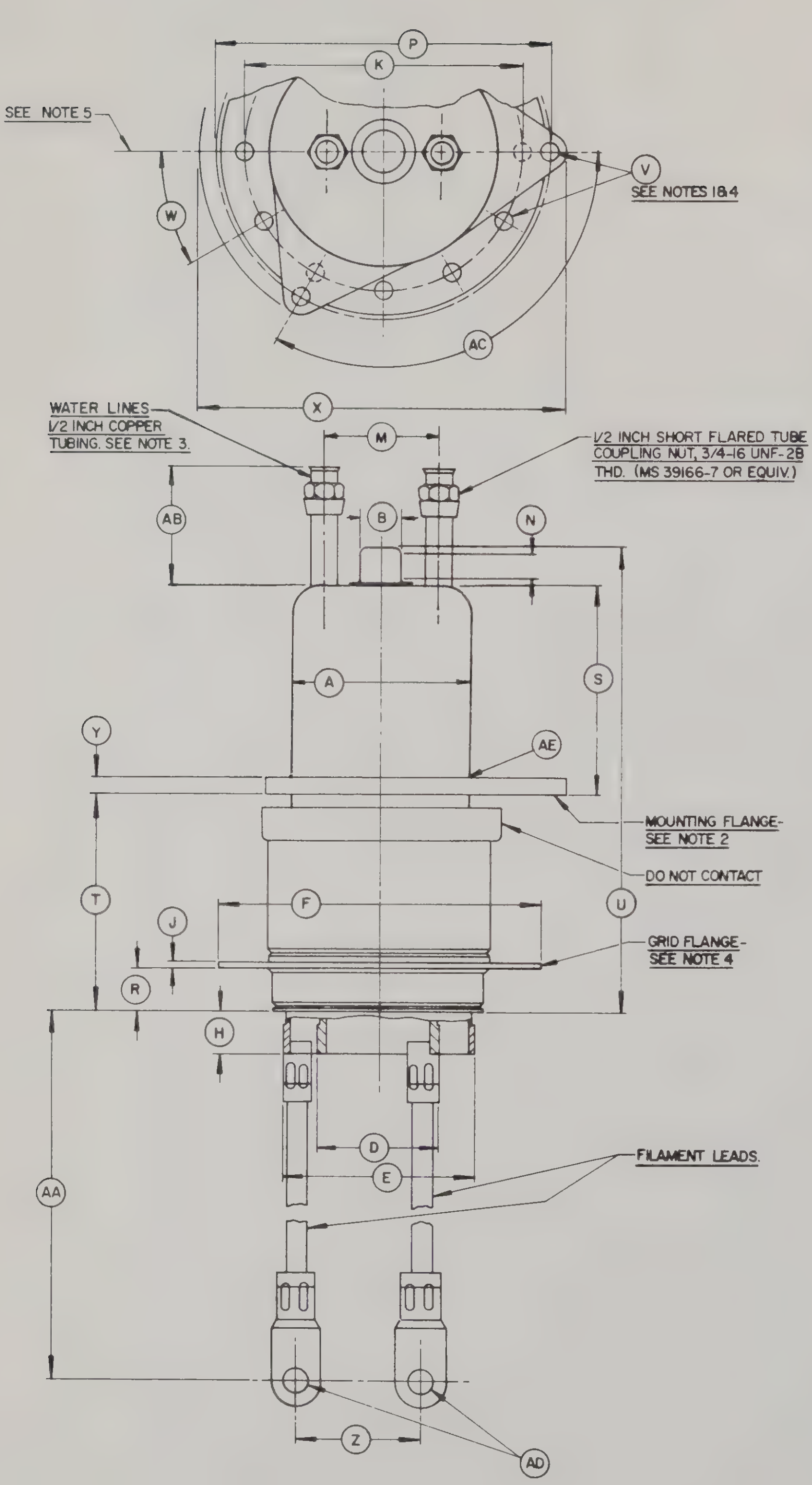
HIGH VOLTAGE - The 3CW10,000H3 operates at voltages which can be deadly, and the equipment must be designed properly and operating precautions must be followed. Equipment must be designed so that no one can come in contact with high voltages. All equipment must include safety enclosures for high-voltage circuits and terminals, with interlock switches to open the primary circuits of the power supplies and to discharge high voltage condensers whenever access doors are opened. Interlock switches must not be bypassed or "cheated" to allow operation with access doors open. Always remember that HIGH VOLTAGE CAN KILL.

X-RAY RADIATION - The 3CW10,000H3, operating at its maximum rated voltage and current, as an industrial oscillator is a potential X-ray hazard. Moreover, the X-ray radiation level can increase significantly with aging and gradual deterioration, due to changes in leakage paths or emission characteristics as they are affected by high voltage. Only limited shielding is afforded by the tube envelope. Additional X-ray shielding must be provided on all sides of the tube to provide adequate protection to operating personnel throughout the tube's life. X-ray caution signs or labels must be permanently attached to equipment using this tube directing operating personnel never to operate this device without X-ray shielding in place.

RADIO FREQUENCY RADIATION - Exposure of the human body to rf radiation becomes increasingly more hazardous as the power level and/or frequency are increased. Exposure to high-power rf radiation must be strictly prevented at any frequency.

Equipment must be designed to fully safeguard all personnel from these hazards. Labels and caution notices must be provided on equipment and in manuals clearly warning of these hazards.

SPECIAL APPLICATIONS - If it is desired to operate this tube under conditions widely different from those given here, write to Power Grid Tube Division, EIMAC, Division of Varian, 301 Industrial Way, San Carlos, California 94070 for information and recommendations.

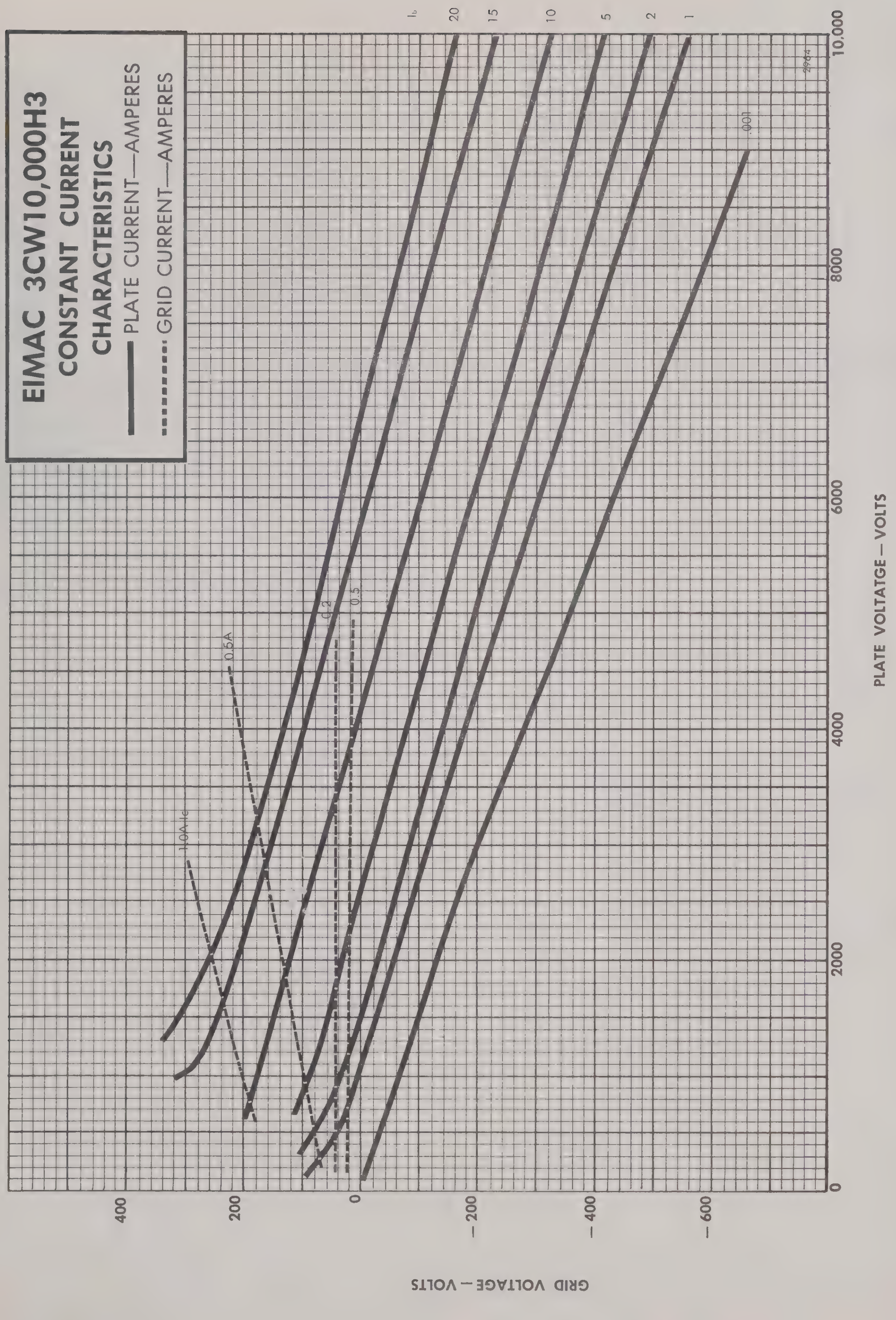

P
K
SEE NOTE 5
V
SEE NOTES 1&4
W
AC
X
WATER LINES 1/2 INCH COPPER TUBING. SEE NOTE 3.
M
1/2 INCH SHORT FLARED TUBE COUPLING NUT, 3/4-16 UNF-2B THD. (MS 39166-7 OR EQUIV.)
AB
B
N
S
A
Y
AE
MOUNTING FLANGE- SEE NOTE 2
DO NOT CONTACT
T
F
U
J
GRID FLANGE- SEE NOTE 4
R
H
D
E
FILAMENT LEADS.
AA
Z
AD

DIMENSIONAL DATA

DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	2.830	3.030	- -	71.88	76.96	- -
B	0.860	0.890	- -	21.84	22.61	- -
D	- -	- -	1.875	- -	- -	47.63
E	- -	- -	3.250	- -	- -	82.55
F	5.030	5.090	- -	127.76	129.29	- -
H	0.530	0.700	- -	13.46	17.78	- -
J	- -	- -	0.125	- -	- -	3.18
K	4.425	4.445	- -	112.40	112.90	- -
M	- -	- -	1.900	- -	- -	48.26
N	0.375	- -	- -	9.53	- -	- -
P	5.990	6.010	- -	152.15	152.65	- -
R	0.700	0.860	- -	17.78	21.84	- -
S	- -	- -	3.350	- -	- -	85.09
T	4.000	4.150	- -	101.60	105.41	- -
U	8.000	8.400	- -	203.20	213.36	- -
V	- -	- -	0.265	- -	- -	6.73
W	29°	31°	- -	29°	31°	- -
X	6.700	6.800	- -	170.18	172.72	- -
Y	- -	- -	0.250	- -	- -	6.35
Z	- -	- -	2.000	- -	- -	50.80
AA	8.500	9.000	- -	215.90	228.60	- -
AB	- -	- -	2.250	- -	- -	57.15
AC	118°	122°	- -	118°	122°	- -
AD	- -	- -	0.390	- -	- -	9.91
AE	- -	- -	0.062R	- -	- -	1.57R

NOTES:

1. REF. DIMS. ARE FOR INFO. ONLY & ARE NOT FOR INSPECTION PURPOSES.
2. 3 MOUNTING HOLES IN MTG. FLANGE.
3. EITHER FITTING CAN BE USED AS INLET OR OUTLET.
4. 12 HOLES IN GRID FLANGE.
5. MTG. FLANGE, FIL. LEADS & WATER FITTING ARE TO BE ORIENTED AS SHOWN.


EIMAC 3CW10,000H3
CONSTANT CURRENT
CHARACTERISTICS
PLATE CURRENT—AMPERES
GRID CURRENT—AMPERES
Ib
20
15
10
5
2
1
.001
1.0A Ic
0.5A
0.2
0.5
2964
400
200
0
−200
−400
−600
GRID VOLTAGE — VOLTS
0
2000
4000
6000
8000
10,000
PLATE VOLTATGE — VOLTS

3CX15,000A7

TECHNICAL DATA

HIGH-MU POWER TRIODE

The EIMAC 3CX15,000A7 is a ceramic/metal power triode intended for use as a zero-bias Class B rf amplifier or Class C power amplifier or oscillator. Class B operation with zero grid bias offers circuit simplicity by eliminating the bias supply. In addition, grounded-grid operation is attractive since a power gain as high as twenty times can be obtained with the 3CX15,000A7.

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Filament: Thoriated Tungsten	
Voltage	6.3 ± 0.3 V
Current, at 6.3 volts	160 A
Amplification Factor (Average):	200
Direct Interelectrode Capacitance (grounded cathode)[2]	
Cin	56 pF
Cout	0.2 pF
Cgp	36 pF
Direct Interelectrode Capacitance (grounded grid)[2]	
Cin	56 pF
Cout	36 pF
Cpk	0.2 pF
Frequency of Maximum Rating:	
CW	110 MHz

---

[1] Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.

[2] Capacitance values are for a cold tube as measured in a special shielded fixture in accordance with Electronic Industries Association Standard RS-191.

MECHANICAL

Maximum Overall Dimensions:	
Length	8.75 in; 222.3 mm
Diameter	7.05 in; 179.1 mm
Net Weight	12 lb; 5.5 kg
Operating Position	Vertical base up or down
Maximum Operating Temperature:	
Ceramic/Metal Seals	250°C
Anode Core	250°C

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Cooling	Forced air
Base	Coaxial
Recommended Air System Socket	SK-1300 or SK-1320
Recommended Air Chimney	SK-1306

RADIO FREQUENCY LINEAR AMPLIFIER CATHODE DRIVEN

Class AB

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE	8000	VOLTS
DC PLATE CURRENT	6.0	AMPERES
PLATE DISSIPATION	15,000	WATTS
GRID DISSIPATION	500	WATTS

TYPICAL OPERATION (Frequencies to 110 MHz)
Class AB_2

Plate Voltage	7000	7000	Vdc
Grid Voltage	0	0	Vdc
Zero-Signal Plate Current[1]	.6	.6	Adc
Single-Tone Plate Current[2]	5.92	5.0	Adc
Single-Tone Grid Current[1]	1.22	1.0	Adc
Driving Power[1]	1750	1540	W
Plate Dissipation	13.4	10.8	kW
Single-Tone Plate Output Power	29.6	24.2	kW
Resonant Load Impedance	693	745	Ω
Drive Impedance	27	32	Ω

1. Approximate values.
2. Adjust to obtain specified value.

RADIO FREQUENCY POWER AMPLIFIER OR OSCILLATOR Class C Telegraphy or FM Telephony

Grid Driven

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE	8000	VOLTS
DC GRID VOLTAGE	-500	VOLTS
DC PLATE CURRENT	5.0	AMPERES
PLATE DISSIPATION	15,000	WATTS
GRID DISSIPATION	500	WATTS

TYPICAL OPERATION (Frequencies to 110 MHz)

Plate Voltage	7000	Vdc
Grid Voltage	-230	Vdc
Plate Current	4.0	Adc
Grid Current[1]	775	mAdc
Peak rf Grid Voltage[1]	555	v
Calculated Driving Power[1]	430	W
Plate Input Power	28	kW
Plate Dissipation	6.7	kW
Plate Output Power	21.3	kW
Resonant Load Impedance	963	Ω

1. Approximate value.

NOTE: TYPICAL OPERATION data are obtained by measurement or calculation from published characteristic curves. Adjustment of the rf grid voltage to obtain the specified plate current at the specified bias, and plate voltages is assumed. If this procedure is followed, there will be little variation in output power when the tube is changed, even though there may be some variation in grid current. The grid current which results when the desired plate current is obtained is incidental and varies from tube to tube. These current variations cause no difficulty so long as the circuit maintains the correct voltage in the presence of the variations in current. If grid bias is obtained principally by means of a grid resistor, the resistor must be adjustable to obtain the required bias voltage when the correct rf grid voltage is applied.

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.	
Heater: Current at 6.3 volts	152	168	A
Cathode Warmup Time	5.0	---	sec.
Interelectrode Capacitances (grounded grid)[1]			
Cin	50.0	62.0	pF
Cout	32.0	40.0	pF
Cpk	---	0.3	pF
Interelectrode Capacitances (grounded cathode)[1]			
Cin	50.0	62.0	pF
Cout	---	0.3	pF
Cgp	32.0	40.0	pF

1. Capacitance values are for a cold tube as measured in a shielded fixture in accordance with Electronic Industries Association Standard RS-191.

APPLICATION

MOUNTING & SOCKETING - The 3CX15,000A7 must be operated vertically, base up or down, and should be protected from severe shock and vibration. The use of an EIMAC air-system socket is recommended. For grid-driven applications, the SK-1300 is used; for cathode-driven circuits, the SK-1320 should be used, as the grid is grounded to the socket frame in this unit. The SK-1306 air chimney is designed to fit around the tube's anode cooler and mount with either socket.

COOLING - The maximum temperature rating for the external surfaces of the 3CX15,000A7 is 250°C. Sufficient forced-air cooling must be provided to maintain the temperature of the anode core and the ceramic/metal seals below 250°C. Tube life is usually prolonged if these areas are maintained at temperatures below the maximum rating. Minimum air flow requirements (for air flowing in a base-to-anode direction) to maintain anode core and seal temperatures below 225°C with an inlet-air temperature of 50°C are tabulated below. The use of these air-flow rates through the recommended socket/chimney combination will provide effective cooling of the tube. Air flow should be applied before or simultaneously with the application of electrode voltages (including the filament) and should normally be maintained for a short period of time after all voltages are removed to allow for tube cool-down.

	SEA LEVEL		10,000 FEET	
Anode Diss. (watts) *	Air Flow (cfm)	Approx. Press. drop (In. H_2O)	Air Flow (cfm)	Approx. Press. drop (In. H_2O)
5,000	242	0.8	350	1.3
7,500	325	1.7	470	2.4
10,000	475	2.8	690	4.1
12,500	640	4.3	930	6.3
15,000	840	6.2	1220	9.7

* Since the power dissipated by the filament is about 1000 watts, and since the grid dissipation can represent another 500 watts, allowance has been made in preparing this tabulation for an additional 1500 watts of dissipation.

FILAMENT OPERATION - The rated filament voltage for the 3CX15,000A7 is 6.3 volts. Filament voltage, as measured at the socket, should be maintained at this value to obtain maximum tube life. In no case should it be allowed to deviate from the rated value by more than plus or minus five percent.

INPUT CIRCUIT - When the 3CX15,000A7 is operated as a ground-grid rf amplifier, the use of a resonant tank in the cathode circuit is recommended in order to obtain greatest linearity and power output. For best results with a single-ended amplifier, it is suggested that the cathode tank circuit operate at a "Q" of two or more.

CLASS-C OPERATION - Although specifically designed for Class-B service, the 3CX15,000A7 may be operated as a Class-C power amplifier or oscillator. The zero-bias characteristic of the 3CX15,000A7 can be used to advantage in Class-C amplifiers by employing only grid-leak bias. If driving power fails, plate dissipation is then kept to a low value because the tube will be operating at the normal static zero-bias conditions.

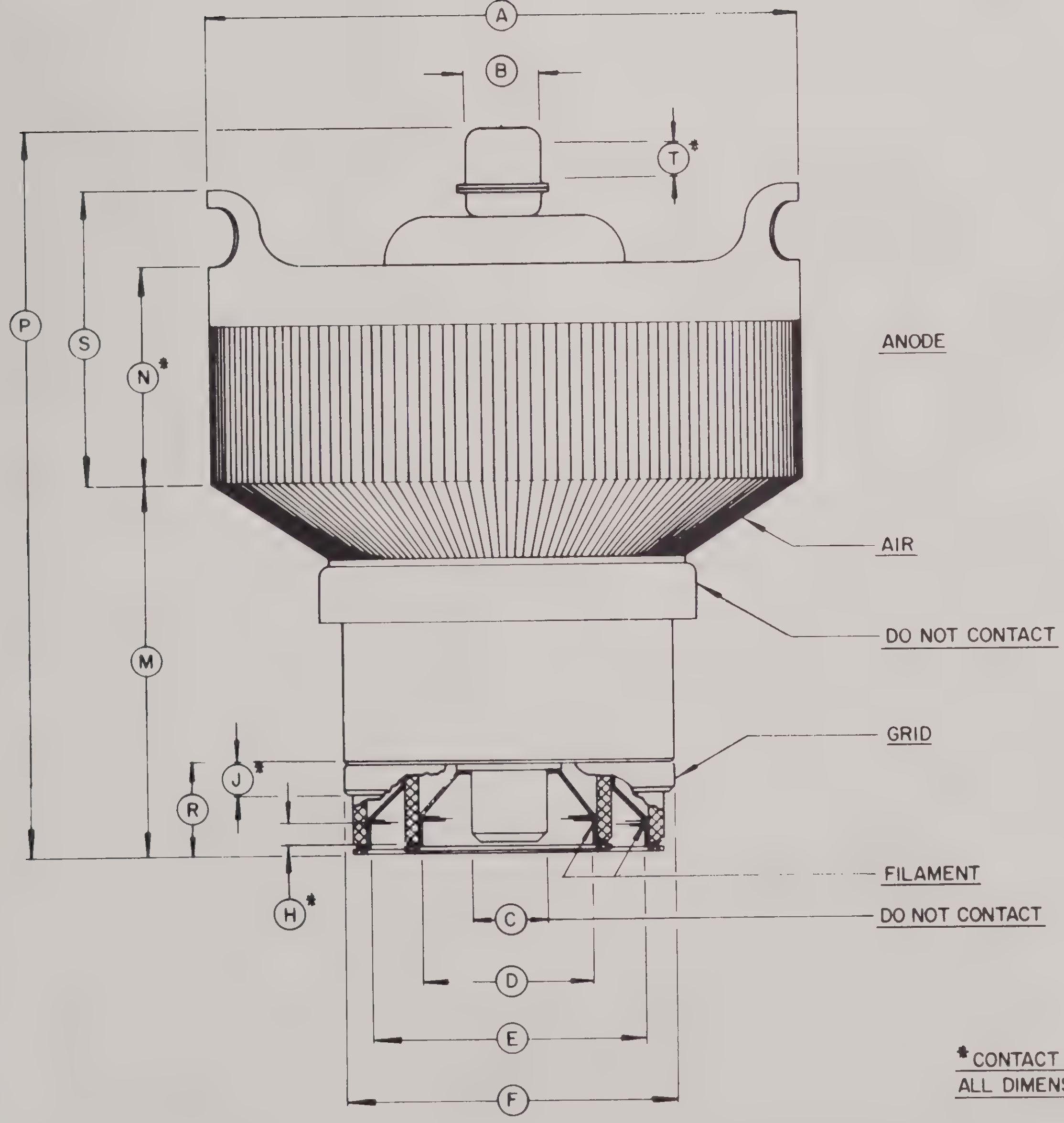
INTERELECTRODE CAPACITANCE - The actual internal interelectrode capacitance of a tube is influenced by many variables in most applications, such as stray capacitance to the chassis, capacitance added by the socket used, stray capacitance between tube terminals, and wiring effects. To control the actual capacitance values within the tube, as the key component involved, the industry and the Military Services use a standard test procedure as described in Electronic Industries Association Standard RS-191. This requires the use of specially constructed test fixtures which effectively shield all external tube leads from each other and eliminates any capacitance reading to "ground". The test is performed on a cold tube. Other factors being equal, controlling internal tube capacitance in this way normally assures good interchangeability of tubes over a period of time, even when the tube may be made by different manufacturers. The capacitance values shown in the manufacturer's technical data, or test specifications, normally are taken in accordance with Standard RS-191.

The equipment designer is therefore cautioned to make allowance for the actual capacitance values which will exist in any normal application. Measurements should be taken with the socket and mounting which represent approximate final layout if capacitance values are highly significant in the design.

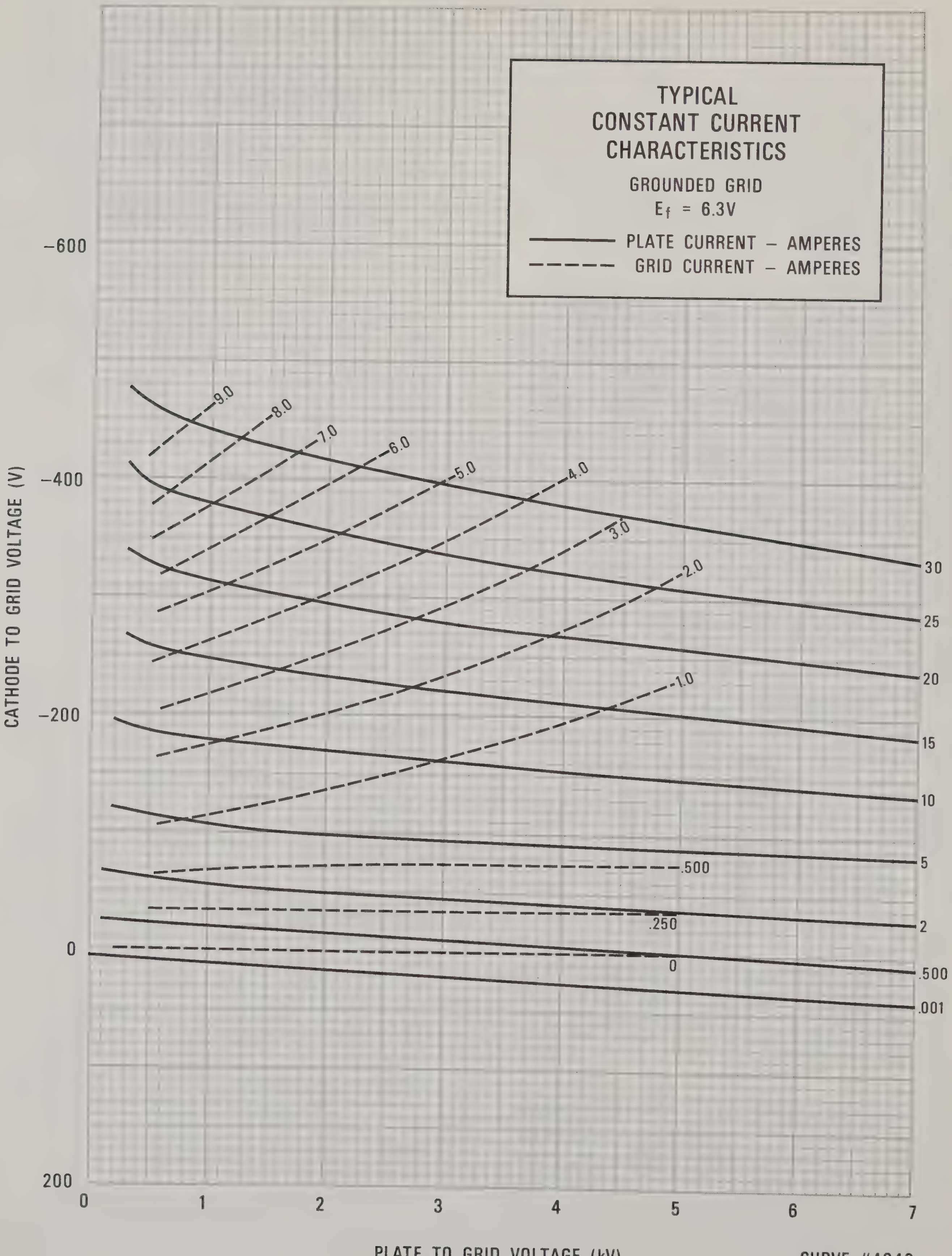
HIGH VOLTAGE - The 3CX15,000A7 operates at voltages which can be deadly, and the equipment must be designed properly and operating precautions must be followed. Equipment must be designed so that no one can come in contact with high voltages. All equipment must include safety enclosures for high-voltage circuits and terminals, with interlock switches to open the primary circuits of the power supplies and to discharge high-voltage condensers whenever access doors are opened. Interlock switches must not be bypassed or "cheated" to allow operation with access doors open. Always remember that HIGH VOLTAGE CAN KILL.

SPECIAL APPLICATIONS - If it is desired to operate this tube under conditions widely different from those given here, write to Power Grid Tube Division, EIMAC Division of Varian, 301 Industrial Way, San Carlos, CA 94070, for information and recommendations.

DIMENSIONAL DATA						
DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	6.928	7.050	- -	175.97	179.07	- -
B	0.855	0.895	- -	21.72	22.73	- -
C	0.720	0.760	- -	18.29	19.30	- -
D	1.896	1.936	- -	48.16	49.17	- -
E	3.133	3.173	- -	79.58	80.59	- -
F	3.792	3.832	- -	96.32	98.86	- -
H	0.188	- -	- -	4.78	- -	- -
J	0.188	- -	- -	4.78	- -	- -
M	3.950	4.300	- -	100.33	109.22	- -
N	2.412	2.788	- -	61.26	70.82	- -
P	8.250	8.750	- -	209.55	222.25	- -
R	0.986	1.050	- -	25.04	26.67	- -
S	3.412	3.788	- -	86.66	96.22	- -
T	0.375	- -	- -	9.53	- -	- -



*CONTACT SURFACE
ALL DIMENSIONS IN INCHES


TYPICAL CONSTANT CURRENT CHARACTERISTICS
GROUNDED GRID
E_f = 6.3V
PLATE CURRENT – AMPERES
GRID CURRENT – AMPERES
CATHODE TO GRID VOLTAGE (V)
-600
-400
-200
0
200
PLATE TO GRID VOLTAGE (kV)
0
1
2
3
4
5
6
7
30
25
20
15
10
5
2
.500
.001
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
.500
.250
0

CURVE #4043

TECHNICAL DATA

3CX20,000A3

MEDIUM-MU
INDUSTRIAL
TRIODE

The EIMAC 3CX20,000A3 is a ceramic insulated power triode for industrial oscillator or general communications service. It is recommended for Class C amplifier service, or Class B radio frequency and audio frequency amplifier use.

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Filament: Thoriated Tungsten	
Voltage	10.0 ± 0.5 V
Current, at 10.0 volts	160 A
Direct Interelectrode Capacitance (grounded cathode)[2]	
Cin	70.0 pF
Cout	2.3 pF
Cgp	43.0 pF
Frequency of Maximum Rating:	
CW	90 MHz

[1] Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.

[2] Capacitance values are for a cold tube as measured in a special shielded fixture in accordance with Electronic Industries Association Standard RS-191.

MECHANICAL

Overall Dimensions:	
Length	10.00 in; 254.0 mm
Diameter	8.00 in; 203.0 mm
Net Weight	19.5 lb; 8.8 kg
Operating Position	Vertical
Maximum Operating Temperature:	
Ceramic/Metal Seals	250°C
Anode Core	250°C
Cooling	Forced air
Base	Coaxial
Recommended Air System Socket	SK-1300

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RADIO FREQUENCY LINEAR AMPLIFIER GRID DRIVEN

Class AB or B

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE	8000	VOLTS
DC GRID VOLTAGE	-2000	VOLTS
DC PLATE CURRENT	8.0	AMPERES
PLATE DISSIPATION	20.0	KILOWATTS
GRID DISSIPATION	750	WATTS

TYPICAL OPERATION Class AB$_2$, Grid Driven, Peak Envelope or Modulation Crest Conditions

Plate Voltage	6500	7500	Vdc
Grid Voltage [1]	-320	-380	Vdc
Zero-Signal Plate Current	1.0	1.0	Adc
Single-Tone Plate Current	6.0	7.4	Adc
Single-Tone Grid Current [2]	460	630	mAdc
Peak rf Grid Voltage [2]	545	640	v
Driving Power	520	400	W
Plate Dissipation	11.5	15.1	kW
Single-Tone Plate Output Power	27.5	40.0	kW
Resonant Load Impedance	580	570	Ω

1. Adjust to specified zero-signal dc plate current.
2. Approximate value.

RADIO FREQUENCY POWER AMPLIFIER OR OSCILLATOR

Class C Telegraphy, Industrial Oscillator (Key-Down Conditions)

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE	12,000	VOLTS
DC GRID VOLTAGE	-2000	VOLTS
DC GRID CURRENT	1.5	AMPERES
DC PLATE CURRENT	8.0	AMPERES
PLATE DISSIPATION	20.0	KILOWATTS
GRID DISSIPATION	750	WATTS

TYPICAL OPERATION

Plate Voltage	7500	10,000	Vdc
Grid Voltage	-800	-900	Vdc
Plate Current	8.0	7.9	Adc
Grid Resistor	575	1180	Ω
Grid Current [1]	1.4	.75	Adc
Peak rf Grid Voltage [1]	1200	1270	v
Calculated Driving Power [1]	1670	960	W
Plate Input Power	60.0	78	kW
Plate Dissipation	9.0	14	kW
Plate Output Power	51.0	64	kW
Resonant Load Impedance	480.0	640	Ω

1. Approximate value.

PLATE MODULATED RADIO FREQUENCY POWER AMPLIFIER-GRID DRIVEN

Class C Telephony (Carrier Conditions)

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE	6500	VOLTS
DC PLATE CURRENT	5.5	AMPERES
PLATE DISSIPATION [1]	13.0	KILOWATTS
GRID DISSIPATION [2]	750	WATTS

1. Corresponds to 20 kW at 100% sine-wave modulation.
2. Average, with or without modulation.

TYPICAL OPERATION

Plate Voltage	6500	Vdc
Grid Voltage	-1300	Vdc
Plate Current	5.0	Adc
Grid Current [1]	900	mAdc
Peak rf Grid Voltage [1]	1660	v
Calculated Driving Power	1500	W
Plate Input Power	32.5	kW
Plate Dissipation	5.0	kW
Plate Output Power	27.5	kW
Resonant Load Impedance	610	Ω

1. Approximate value.

AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR

Class AB, Grid Driven (Sinusoidal Wave)

ABSOLUTE MAXIMUM RATINGS (per tube)

DC PLATE VOLTAGE	8000	VOLTS
DC PLATE CURRENT	8.0	AMPERES
PLATE DISSIPATION	20.0	KILOWATTS
GRID DISSIPATION	750	WATTS

TYPICAL OPERATION (Two Tubes)

Plate Voltage	7500	Vdc
Grid Voltage [1/3]	-380	Vdc
Zero-Signal Plate Current	2.0	Adc
Max. Signal Plate Current	14.8	Adc
Max. Signal Grid Current [1]	1.26	Adc
Peak af Grid Voltage [2]	640	v
Driving Power	800	W
Max. Signal Plate Dissipation	30.2	kW
Plate Output Power	80.0	kW
Load Resistance (plate to plate)	1140	Ω

1. Approximate value.
2. Per Tube.
3. Adjust to give stated zero-signal plate current.

NOTE: TYPICAL OPERATION data are obtained by measurement or calculation from published characteristic curves. Adjustment of the rf grid voltage to obtain the specified plate current at the specified bias, and plate voltages is assumed. If this procedure is followed, there will be little variation in output power when the tube is changed, even though there may be some variation in grid current. The grid current which results when the desired plate current is obtained is incidental and varies from tube to tube. These current variations cause no difficulty so long as the circuit maintains the correct voltage in the presence of the variations in current. If grid bias is obtained principally by means of a grid resistor, the resistor must be adjustable to obtain the required bias voltage when the correct rf grid voltage is applied.

RANGE VALUES FOR EQUIPMENT DESIGN

Heater: Current at 10.0 volts	152	168	A
Interelectrode Capacitances[1] (grounded cathode connection)			
Cin	65.0	75.0	pF
Cout	2.00	2.60	pF
Cgp	38.0	48.0	pF

1. Capacitance values are for a cold tube as measured in a special shielded fixture in accordance with Electronic Industries Association Standard RS-191.

APPLICATION

MECHANICAL

COOLING - The maximum temperature rating for the external surfaces of the 3CX20,000A3 is 250°C. Sufficient forced-air flow must be provided to keep the temperature of the anode at the base of the cooling fins and the temperature of the ceramic/metal seals below 250°C. Air flow requirements to maintain core temperature at 225°C in 50°C ambient air are tabulated below. These data are for air flowing in the base-to-anode direction, and the pressure drop figures shown are for the tube/socket/chimney combination.

BASE-TO-ANODE AIR FLOW				
	Sea Level		10,000 Feet	
Plate * Dissipation (watts)	Air Flow (CFM)	Pressure Drop In. H2O	Air Flow (CFM)	Pressure Drop In. H2O
10,000	320	1.0	464	1.6
15,000	625	3.0	910	4.4
20,000	1010	6.0	1475	8.7

* Since the power dissipated by the filament represents about 1680 watts and since the grid dissipation can, under some conditions, represent another 750 watts, allowance has been made in preparing this tabulation for an additional 2430 watts dissipation.

The blower selected in a given application must be capable of supplying the desired air flow at a back pressure equal to the pressure drop shown above plus any drop encountered in ducts and filters.

At other altitudes and ambient temperatures, the flow rate must be modified to obtain equivalent cooling. The flow rate and corresponding pressure differential must be determined individually in such cases, using rated maximum temperatures as the criteria for satisfactory cooling.

ELECTRICAL

FILAMENT/CATHODE OPERATION - The filament voltage should be maintained within 5% of the nominal 10.0 V value, and for consistent tube life even closer control is advised. For most services the filament voltage may be less than the nominal 10.0 V for extended life. The exact value about which to control should be determined by experiment in any given service.

GRID OPERATION - The grid dissipation rating of 750 watts must not be exceeded. For the convenience of industrial heating operators a maximum grid current of 1.5 amperes is specified. This provides reasonable assurance that the 750 watt rating is not exceeded.

PLATE OPERATION - Allowable anode dissipation depends on provision of sufficient cooling air for the temperature and altitude environment. Anode dissipation will vary widely with load changes in industrial heating service. It is important that the power level be adjusted so that under no condition of the load cycle does the anode dissipation exceed the level established by the available cooling air. When power tubes are operated in parallel, provision should be made to meter plate and grid currents individually. It is good practice also to provide separate plate current or cathode current overload relays when tubes are operated in parallel.

RADIO FREQUENCY RADIATION - Avoid exposure to strong rf fields even at relatively low frequency. Absorption of rf energy by human tissue is dependent on frequency. Under 30 MHz, most of the energy will pass completely through the human body with little attenuation or heating effect. Public health agencies are concerned with the hazard, however, even at these frequencies, and it is worth noting that some commercial dielectric heating units actually operate at frequencies as low as the 13 and 27 MHz bands.

Many EIMAC power tubes, such as the 3CX-20,000A3, are specifically designed to generate or amplify radio frequency power. There may be a relatively strong rf field in the general proximity of the power tube and its associated circuitry--- the more power involved, the stronger the rf field. Proper enclosure design and efficient coupling of rf energy to the load will minimize the rf field in the vicinity of the power amplifier unit itself.

HIGH VOLTAGE - Normal operating voltages used with the 3CX20,000A3 are deadly, and the equipment must be designed properly and operating precautions must be followed. Design all equipment so that no one can come in contact with high voltages. All equipment must include safety enclosures for high-voltage circuitx and terminals, with interlock switches to open primary circuits of the power supply and to discharge high-voltage condensers whenever access doors are opened. Interlock switches must not be bypassed or "cheated" to allow operation with access doors open. Always remember that HIGH VOLTAGE CAN KILL.

X-RADIATION - High-vacuum tubes operating at voltages higher than 10 kilovolts produce progressively more dangerous X-ray radiation as the voltage is increased. The 3CX20,000A3, operating at its rated voltages and currents, is a potential X-ray hazard. Only limited shielding is afforded by the tube envelope. Moreover, the X-ray radiation level can increase significantly with aging and gradual deterioration, due to leakage paths or emission characteristics as they are affected by the high voltage. X-ray shielding must be provided on all sides of tubes operating at these voltages to provide adequate protection throughout the tube's life. Periodic checks on the X-ray level should be made, and the tube should never be operated without adequate shielding in place when voltages above 10 kilovolts are in use. Lead glass, which attenuates X-rays, is available for viewing windows. If there is any doubt as to the requirement for or the adequacy of shielding an expert in this field should be contacted to perform an X-ray survey of the equipment.

Operation of high-voltage equipment with interlock switches "cheated" and cabinet doors open in order to be better able to locate an equipment malfunction can result in serious X-ray exposure.

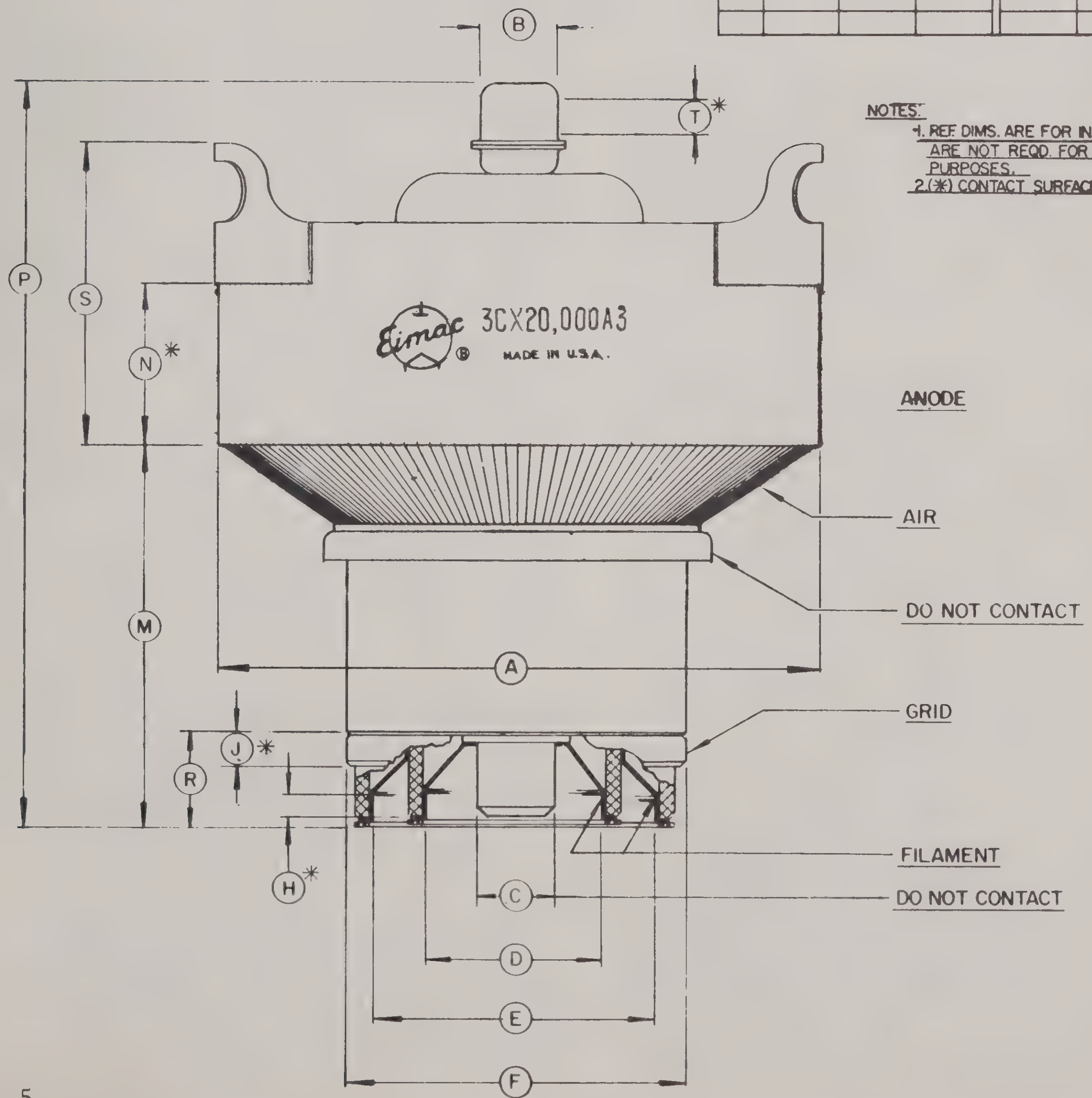
INTERELECTRODE CAPACITANCE - The actual internal interelectrode capacitance of a tube is influenced by many variables in most applications, such as stray capacitance to the chassis, capacitance added by the socket used, stray capacitance between tube terminals, and wiring effects. To control the actual capacitance values within the tube, as the key component involved, the industry and the Military Services use a standard test procedure as described in Electronic Industries Association Standard RS-191. This requires the use of specially constructed test fixtures which effectively shield all external tube leads from each other and eliminates any capacitance reading to "ground". The test is performed on a cold tube. Other factors being equal, controlling internal tube capacitance in this way normally assures good interchangeability of tubes over a period of time, even when the tube may be made by different manufacturers. The capacitance values shown in the manufacturer's technical data, or test specifications, normally are taken in accordance with Standard RS-191.

The equipment designer is therefore cautioned to make allowance for the actual capacitance values which will exist in any normal application. Measurements should be taken with the socket and mounting which represent approximate final layout if capacitance values are highly significant in the design.

SPECIAL APPLICATION - If it is desired to operate this tube under conditions widely different from those listed here, write to Power Grid Tube Division, EIMAC Division of Varian, 301 Industrial Way, San Carlos, California 94070, for information and recommendations.

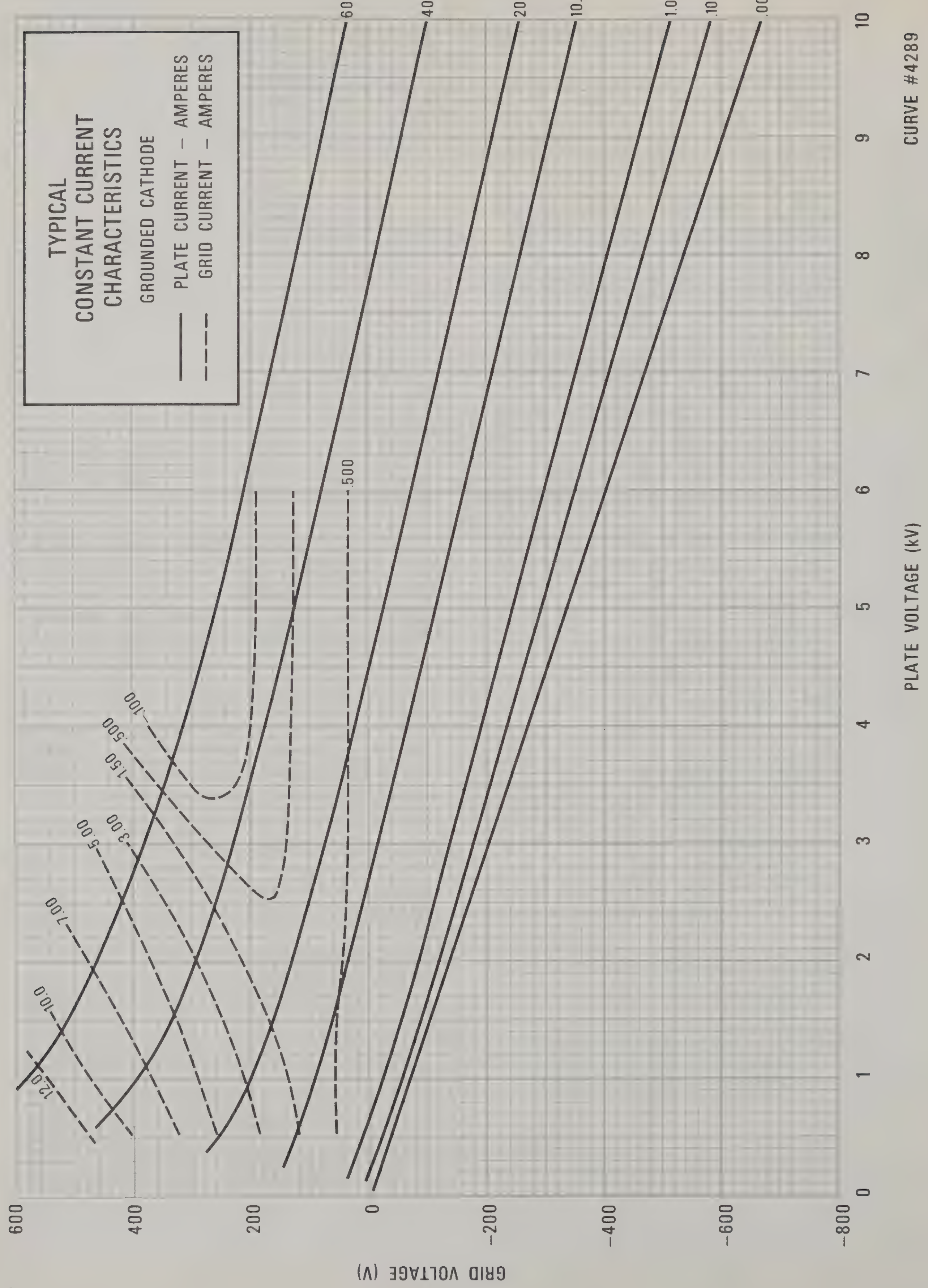
DIMENSIONAL DATA

DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	- -	- -	8.000	- -	- -	204.00
B	0.855	0.895	- -	21.70	22.70	- -
C	0.720	0.760	- -	18.30	19.30	- -
D	1.896	1.936	- -	- -	- -	- -
E	3.133	3.173	- -	79.58	80.59	- -
F	3.792	3.832	- -	96.32	97.33	- -
H	0.188	- -	- -	4.77	- -	- -
J	0.188	- -	- -	4.77	- -	- -
M	3.800	4.150	- -	96.50	105.00	- -
N	- -	- -	3.200	- -	- -	81.28
P	- -	- -	10.000	- -	- -	254.00
R	0.986	1.050	- -	25.10	26.70	- -
S	- -	- -	5.000	- -	- -	127.00
T	0.375	- -	- -	9.50	- -	- -



NOTES:

1. REF. DIMS. ARE FOR INFO. ONLY ARE NOT REQD. FOR INSPECTION PURPOSES.
2. (*) CONTACT SURFACES


TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
GROUNDED CATHODE
PLATE CURRENT – AMPERES
GRID CURRENT – AMPERES
60.0
40.0
20.0
10.0
1.00
.100
.001
.500
12.0
10.0
7.00
5.00
3.00
1.50
.500
.100
GRID VOLTAGE (V)
600
400
200
0
–200
–400
–600
–800
PLATE VOLTAGE (kV)
0
1
2
3
4
5
6
7
8
9
10
CURVE #4289

TECHNICAL DATA

3CX20,000H3

MEDIUM-MU INDUSTRIAL TRIODE

The 3CX20,000H3 is a ceramic insulated medium-mu power triode with terminals arranged for direct mounting in industrial heating equipment without the use of a socket. The 3CX20,000H3 is recommended for use as an industrial oscillator in the LF to lower VHF range (30 KHz to 90 MHz). This triode is also recommended for the AM broadcast service as a modulator, modulated rf stage, or as a linear amplifier.

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Filament: Thoriated Tungsten	
Voltage	10.0 ± 0.5 V
Current, at 10.0 volts	160 A
Direct Interelectrode Capacitance (grounded cathode)[2]	
Cin	70.0 pF
Cout	2.3 pF
Cgp	43.0 pF
Frequency of Maximum Rating:	
CW	90 MHz

1. Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.

2. Capacitance values are for a cold tube as measured in a special shielded fixture in accordance with Electronic Industries Association Standard RS-191.

MECHANICAL

Overall Dimensions:	
Length (Not including filament leads)	10.60 in: 269.2 mm
Diameter	8.00 in; 203.2 mm
Net Weight	20.0 lb; 9.1 kg
Operating Position	Vertical, anode up or down
Maximum Operating Temperature:	
Ceramic/Metal Seals	250°C
Anode Core	250°C
Cooling	Forced air
Base	Flexible filament leads

(Effective 5-1-71) © by Varian Printed in U.S.A.

RADIO FREQUENCY POWER AMPLIFIER OR OSCILLATOR

Class C Telegraphy, or Industrial Oscillator
(Key-Down Conditions)

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE	12,000	VOLTS
DC GRID VOLTAGE	-2000	VOLTS
DC GRID CURRENT	1.5	AMPERES
DC PLATE CURRENT	8.0	AMPERES
PLATE DISSIPATION	20.0	KILOWATTS
GRID DISSIPATION	750	WATTS

TYPICAL OPERATION

Plate Voltage	7500	10,000	Vdc
Grid Voltage	-800	-900	Vdc
Plate Current	8.0	7.9	Adc
Grid Current[1]	1.4	.75	Adc
Peak rf Grid Voltage[1]	1200	1270	v
Calculated Driving Power[1]	1670	960	W
Plate Input Power	60	78	kW
Plate Dissipation	9.0	14.0	kW
Plate Output Power	51.0	64.0	kW
Resonant Load Impedance	480	640	Ω

1. Approximate value.

PLATE MODULATED RADIO FREQUENCY POWER AMPLIFIER-GRID DRIVEN

Class C Telephony (Carrier Conditions)

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE	6500	VOLTS
DC GRID VOLTAGE	-2000	VOLTS
DC PLATE CURRENT	5.5	AMPERES
PLATE DISSIPATION[1]	13.0	KILOWATTS
GRID DISSIPATION[2]	750	WATTS

1. Corresponds to 20,000 watts at 100% sine-wave modulation.
2. Average, with or without modulation.

TYPICAL OPERATION

Plate Voltage	6500	Vdc
Grid Voltage	-1300	Vdc
Plate Current	5.0	mAdc
Grid Current[1]	900	mAdc
Peak rf Grid Voltage[1]	1660	v
Calculated Driving Power	1500	W
Plate Input Power	32.5	kW
Plate Dissipation	5.0	kW
Plate Output Power	27.5	kW
Resonant Load Impedance	610	Ω

1. Approximate value.

AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR

Class AB, Grid Driven (Sinusoidal Wave)

ABSOLUTE MAXIMUM RATINGS (per tube)

DC PLATE VOLTAGE[1]	8000	VOLTS
DC PLATE CURRENT	8.0	AMPERES
PLATE DISSIPATION	20.0	KILOWATTS
GRID DISSIPATION	750	WATTS

1. Approximate value.

TYPICAL OPERATION (Two Tubes)

Plate Voltage	7500	Vdc
Grid Voltage[1/3]	-380	Vdc
Zero-Signal Plate Current	2.0	Adc
Max. Signal Plate Current	14.8	Adc
Max. Signal Grid Current[1]	1.26	Adc
Peak af Grid Voltage[2]	640	v
Driving Power[1]	800	W
Max. Signal Plate Dissipation	30.2	kW
Plate Output Power	80.0	kW
Load Resistance (plate to plate)	1140	Ω

2. Per Tube.
3. Adjust to give stated zero-signal plate current

NOTE: TYPICAL OPERATION data are obtained by measurement or calculation from published characteristic curves. Adjustment of the rf grid voltage to obtain the specified plate current at the specified bias, and plate voltages is assumed. If this procedure is followed, there will be little variation in output power when the tube is changed, even though there may be some variation in grid current. The grid current which results when the desired plate current is obtained is incidental and varies from tube to tube. These current variations cause no difficulty so long as the circuit maintains the correct voltage in the presence of the variations in current. If grid bias is obtained principally by means of a grid resistor, the resistor must be adjustable to obtain the required bias voltage when the correct rf grid voltage is applied.

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.	
Heater: Current at 10.0 volts	152	168	A
Interelectrode Capacitances[1] (grounded cathode connection)			
Cin	65.0	75.0	pF
Cout	2.00	2.60	pF
Cgp	38.0	48.0	pF

1. Capacitance values are for a cold tube as measured in a special shielded fixture in accordance with Electronic Industries Association Standard RS-191.

APPLICATION

MECHANICAL

MOUNTING - The 3CX20,000H3 is intended for direct mounting in the equipment. It may be supported by the anode cooler or by the grid terminal flange. It must be mounted vertically, base up, or base down. The filament terminals are flexible leads approximately eight and three quarter inches in length. At higher operating frequencies it is suggested that the RF return to the filament be made to one or both of the heavy filament rings by suitable clamps. In circuits where circulating current may be large it is possible to make the grid connection through a wide strap bolted to one or more of the ¼ inch holes in the grid flange.

COOLING - The maximum temperature rating for the external surfaces of the 3CX20,000H3 is 250°C. Sufficient forced-air flow must be provided to keep the temperature of the anode at the base of the cooling fins and the temperature of the ceramic/metal seals below 250°C. Air flow requirements to maintain core temperature at 225°C in 50°C ambient air are tabulated below. These data are for air flowing in the base-to-anode direction.

The anode cooling air table assumes that the 3CX20,000H3 will be mounted in an enclosure with cooling air flowing into the enclosure and being exhausted through the anode cooler. If the air flow is reversed, that is, flow from the anode toward the base, approximately 20% additional air flow should be provided as indicated by 33% higher pressure drop across the anode cooler.

Approximately 100 CFM of air should be directed from a 1-½ inch diameter nozzle into the base of the tube to cool the filament terminals.

BASE TO ANODE AIR FLOW				
	Sea Level		10,000 Feet	
Plate * Dissipation (watts)	Air Flow (CFM)	Pressure Drop In. W.C.	Air Flow (CFM)	Pressure Drop In. W.C.
10,000	320	0.9	464	1.1
15,000	625	2.1	910	2.8
20,000	1010	4.3	1475	5.8

* Since the power dissipated by the filament represents about 1680 watts and since the grid dissipation can, under some conditions, represent another 750 watts, allowance has been made in preparing this tabulation for an additional 2430 watts dissipation.

The blower selected in a given application must be capable of supplying the desired air flow at a back pressure equal to the pressure drop shown above plus any drop encountered in ducts and filters.

At other altitudes and ambient temperatures, the flow rate must be modified to obtain equivalent cooling. The flow rate and corresponding pressure differential must be determined individually in such cases, using rated maximum temperatures as the criteria for satisfactory cooling.

ELECTRICAL

FILAMENT/CATHODE OPERATION - The filament voltage should be maintained within 5% of the nominal 10.0 V value, and for consistent tube life even closer control is advised. For most services the filament voltage may be less than the nominal 10.0 V for extended life.

The exact value about which to control should be determined by experiment in any given service.

GRID OPERATION - The grid dissipation rating of 750 watts must not be exceeded. For the convenience of industrial heating operators a maximum grid current of 1.5 amperes is specified. This provides reasonable assurance that the 750 watt rating is not exceeded.

PLATE OPERATION - Allowable anode dissipation depends on provision of sufficient cooling air for the temperature and altitude environment.

Anode dissipation will vary widely with load changes in industrial heating service. It is important that the power level be adjusted so that under no condition of the load cycle does the anode dissipation exceed the level established by the available cooling air.

When power tubes are operated in parallel, provision should be made to meter plate and grid currents individually. It is good practice also to provide separate plate current or cathode current overload relays when tubes are operated in parallel.

INTERELECTRODE CAPACITANCE - The actual internal interelectrode capacitance of a tube is influenced by many variables in most applications, such as stray capacitance to the chassis, capacitance added by the socket used, stray capacitance between tube terminals, and wiring effects. To control the actual capacitance values within the tube, as the key component involved, the industry and the Military Services use a standard test procedure as described in Electronic Industries Association Standard RS-191. This requires the use of specially constructed test fixtures which effectively shield all external tube leads from each other and eliminates any capacitance reading to "ground". The test is performed on a cold tube. Other factors being equal, controlling internal tube capacitance in this way normally assures good interchangeability of tubes over a period of time, even when the tube may be made by different manufacturers. The capacitance values shown in the manufacturer's technical data, or test specifications, normally are taken in accordance with Standard RS-191.

The equipment designer is therefore cautioned to make allowance for the actual capacitance values which will exist in any normal application. Measurements should be taken with the socket and mounting which represent approximate final layout if capacitance values are highly significant in the design.

HIGH VOLTAGE - Normal operating voltages used with the 3CX20,000H3 are deadly, and the equipment must be designed properly and operating precautions must be followed. Design all equipment so that no one can come in contact with high voltages. All equipment must include safety enclosures for high-voltage circuits and terminals, with interlock switches to open primary circuits of the power supply and to discharge high-voltage condensers whenever access doors are opened. Interlock switches must not be bypassed or "cheated" to allow operation with access doors open. Always remember that HIGH VOLTAGE CAN KILL.

X-RADIATION - High-vacuum tubes operating at voltages higher than 10kilovolts produce progressively more dangerous X-ray radiation as the voltage is increased. The 3CX20,000H3, operating at its rated voltages and currents, is a potential X-ray hazard. Only limited shielding is afforded by the tube envelope. Moreover, the X-ray radiation level can increase significantly with aging and gradual deterioration, due to leakage paths or emission characteristics as they are affected by the high voltage. X-ray shielding must be provided on all sides of tubes operating at these voltages to provide adequate protection throughout the tube's life. Periodic checks on the X-ray level should be made, and the tube should never be operated without adequate shielding in place when voltages above 10 kilovolts are in use. Lead glass, which attenuates X-rays, is available for viewing windows. If there is any doubt as to the requirement for or the adequacy of shielding, an expert in this field should be contacted to perform an X-ray survey of the equipment.

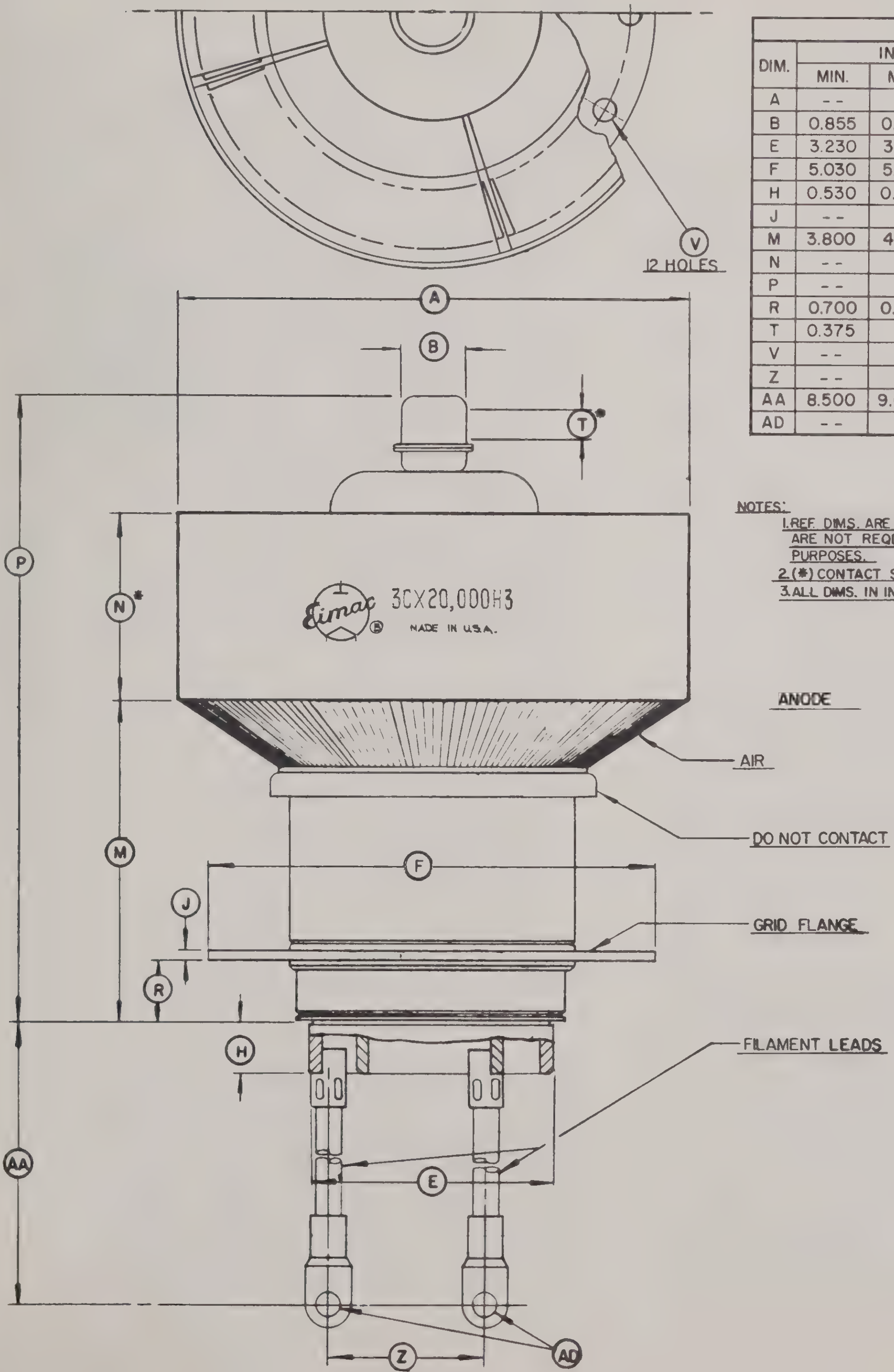
Operation of high-voltage equipment with interlock switches "cheated" and cabinet doors open in order to be better able to locate an equipment malfunction can result in serious X-ray exposure.

RADIO FREQUENCY RADIATION - Avoid exposure to strong rf fields even at relatively low frequency. Absorption of rf energy by human tissue is dependent on frequency. Under 30 MHz, most of the energy will pass completely through the human body with little attenuation or heating effect. Public health agencies are concerned with the hazard, however, even at these frequencies, and it is worth noting that some commercial dielectric heating units actually operate at frequencies as low as the 13 and 27 MHz bands.

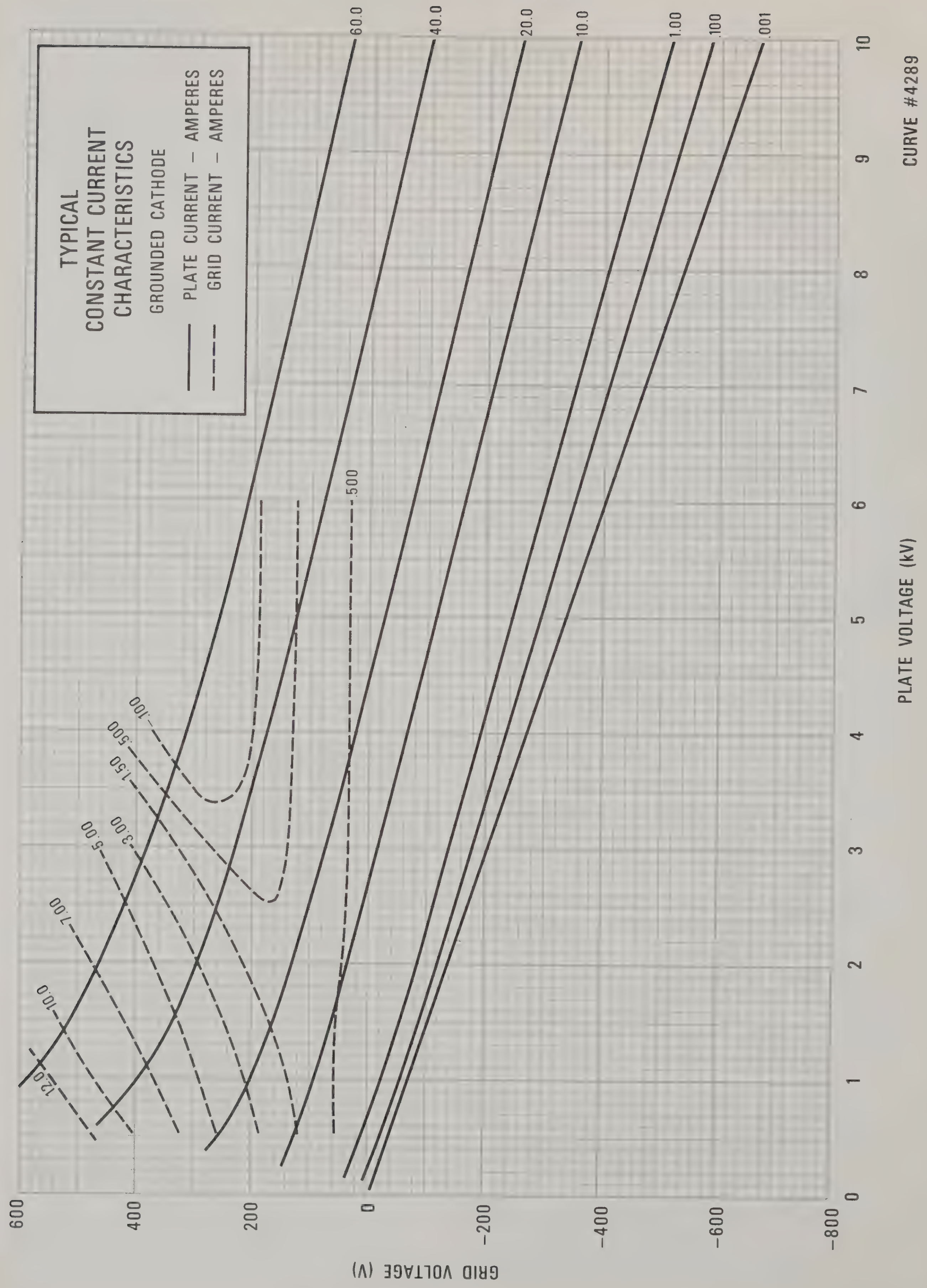
Many EIMAC power tubes, such as the 3CX-20,000H3 are specifically designed to generate or amplify radio frequency power. There may be a relatively strong rf field in the general proximity of the power tube and its associated circuitry --- the more power involved, the stronger the rf field. Proper enclosure design and efficient coupling of rf energy to the load will minimize the rf field in the vicinity of the power amplifier unit itself.

SPECIAL APPLICATIONS - If it is desired to operate this tube under conditions widely different from those given here, write to Power Grid Tube Product Manager, EIMAC Division of Varian, 301 Industrial Way, San Carlos, California 94070 for information and recommendations.

DIMENSIONAL DATA						
DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	- -	- -	8.00	- -	- -	203.0
B	0.855	0.895	- -	21.70	22.70	- -
E	3.230	3.270	- -	82.00	83.00	- -
F	5.030	5.090	- -	128.00	128.70	- -
H	0.530	0.700	- -	13.50	17.70	- -
J	- -	- -	0.125	- -	- -	3.20
M	3.800	4.150	- -	96.50	105.00	- -
N	- -	- -	4.000	- -	- -	115.00
P	- -		10.000	- -	- -	254.00
R	0.700	0.860	- -	17.80	21.80	- -
T	0.375	- -	- -	9.50	- -	- -
V	- -	- -	0.265	- -	- -	6.70
Z	- -	- -	2.000	- -	- -	51.00
AA	8.500	9.000	- -	215.00	228.00	- -
AD	- -	- -	0.390	- -	- -	9.90



NOTES:
1. REF. DIMS. ARE FOR INFO. ONLY & ARE NOT REQD. FOR INSPECTION PURPOSES.
2. (*) CONTACT SURFACES
3. ALL DIMS. IN INCHES


TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
GROUNDED CATHODE
PLATE CURRENT – AMPERES
GRID CURRENT – AMPERES
60.0
40.0
20.0
10.0
1.00
.100
.001
.500
12.0
10.0
7.00
5.00
3.00
1.50
.500
.100
600
400
200
0
–200
–400
–600
–800
GRID VOLTAGE (V)
0
1
2
3
4
5
6
7
8
9
10
PLATE VOLTAGE (kV)
CURVE #4289

Eimac®

EITEL-McCULLOUGH, INC.

8161
3X2500A3

MEDIUM MU TRIODE

The Eimac 8161/3X2500A3 is a medium-mu, forced-air-cooled, external-anode transmitting triode with a maximum plate-dissipation rating of 2500 watts. Relatively high power output as an amplifier, oscillator or modulator may be obtained from this tube at low plate voltages. A single tube will deliver a radio-frequency output of 7500 watts at 4000 plate volts at frequencies up to 110 Mc., as well as at lower frequencies.

The tube has a rugged, low-inductance cylindrical filament-stem structure, which readily becomes part of a linear filament tank circuit for V.H.F. operation. The grid provides thorough shielding between the input and output circuits for grounded-grid applications and is conveniently terminated in a ring between the plate and filament terminals. The 8161/3X2500A3 may be installed or removed without the aid of tools.

The approved Federal Communications Commission rating for the 8161/3X2500A3 is 5000 watts of carrier power when used as a plate-modulated amplifier and 1250 watts of carrier power when used as a grid-modulated or linear amplifier.

GENERAL CHARACTERISTICS

ELECTRICAL

	Min.	Nom.	Max.	
Filament: Thoriated Tungsten				
Voltage		7.5		volts
Current	49		54	amperes
Amplification Factor	19		26	
Direct Interelectrode Capacitances				
Grid-Plate	16.8		23.2	uuf
Grid-Filament	29.2		40.2	uuf
Plate-Filament	0.6		1.2	uuf
Transconductance (I_b=830 ma., E_b=3000 v.)		20,000		umhos
Highest Frequency for Maximum Ratings			75	mc

MECHANICAL

Base	See drawing
Mounting	Vertical, base down or up
Cooling	Forced air
▶ Maximum Anode Cooler Core and Seal Temperatures	175° C
Maximum Over-All Dimensions:	
Length	8.6 inches
Diameter	4.16 inches
Net Weight	6.25 pounds
Shipping Weight (Average)	17 pounds

RADIO-FREQUENCY POWER AMPLIFIER OR OSCILLATOR

(Conventional Neutralized Amplifier—Frequencies below 75Mc.)

Class-C FM or Telegraphy (Key-down conditions, per tube)

MAXIMUM RATINGS	
D-C PLATE VOLTAGE	6000 MAX. VOLTS
D-C PLATE CURRENT	2.5 MAX. AMPS
PLATE DISSIPATION	2500 MAX. WATTS
▶ PLATE COOLER CORE TEMPERATURE	175 MAX. ° C
GRID DISSIPATION	150 MAX. WATTS

TYPICAL OPERATION (Frequencies below 75 Mc. per tube)

D-C Plate Voltage	4000	5000	6000	volts
D-C Plate Current	2.5	2.5	2.08	amps
D-C Grid Voltage	—300	—450	—500	volts
D-C Grid Current*	245	265	180	ma
Peak R-F Grid Input Voltage*	580	750	765	volts
Driving Power*	142	197	136	watts
Grid Dissipation*	68	78	46	watts
Plate Power Input	10,000	12,500	12,500	watts
Plate Dissipation	2500	2500	2500	watts
Plate Power Output	7500	10,000	10,000	watts

RADIO-FREQUENCY POWER AMPLIFIER

Grounded-Grid Circuit

Class-C FM Telephony

MAXIMUM RATINGS (Frequencies between 75 and 110 Mc.)	
D-C PLATE VOLTAGE	4000 MAX. VOLTS
D-C PLATE CURRENT	2.0 MAX. AMPS
D-C GRID CURRENT	200 MAX. MA
PLATE DISSIPATION	2500 MAX. WATTS
▶ PLATE COOLER CORE TEMPERATURE	175 MAX. ° C
GRID DISSIPATION	150 MAX. WATTS

TYPICAL OPERATION (110 Mc., per tube)

D-C Plate Voltage	3700	4000	volts
D-C Grid Voltage	—450	—500	volts
D-C Plate Current	1.8	1.85	amps
D-C Grid Current*	190	190	ma
Driving Power*	1600	1900	watts
Useful Power Output	6850	7500	watts

PLATE-MODULATED RADIO-FREQUENCY AMPLIFIER

(Conventional Neutralized Amplifier—Frequencies below 75 Mc.)

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS	
D-C PLATE VOLTAGE	5000 MAX. VOLTS
D-C PLATE CURRENT	2.0 MAX. AMPS
PLATE DISSIPATION	1670 MAX. WATTS
▶ PLATE COOLER CORE TEMPERATURE	175 MAX. ° C
GRID DISSIPATION	150 MAX. WATTS

TYPICAL OPERATION (Frequencies below 75 Mc., per tube)

D-C Plate Voltage	4000	4500	5000	volts
D-C Plate Current	1.67	1.47	1.25	amps
D-C Grid Voltage	—450	—500	—550	volts
D-C Grid Current*	180	140	150	ma
Peak R-F Grid Input Voltage*	685	715	760	volts
Driving Power*	125	100	115	watts
Grid Dissipation*	43	30	32	watts
Plate Power Input	6670	6615	6250	watts
Plate Dissipation	1670	1315	950	watts
Plate Power Output	5000	5300	5300	watts

*Approximate values.

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▶ Indicates change from sheet dated 1-1-61

AUDIO-FREQUENCY POWER AMPLIFIER OR MODULATOR

Class-AB or B
MAXIMUM RATINGS

D-C PLATE VOLTAGE - - - - -	6000 MAX. VOLTS
D-C PLATE CURRENT - - - - -	2.5 MAX. AMPS
PLATE DISSIPATION - - - - -	2500 MAX. WATTS
GRID DISSIPATION - - - - -	150 MAX. WATTS

TYPICAL OPERATION (Sinusoidal wave, two tubes unless noted)

D-C Plate Voltage - - - - - -	4000	5000	6000	volts
D-C Grid Voltage[1] - - - - -	—150	—190	—240	volts
Zero-Signal D-C Plate Current - - -	0.6	0.5	0.4	amps
Max-Signal D-C Plate Current - - -	4.0	3.2	3.0	amps
Effective Load, Plate to Plate - - -	2200	3600	4650	ohms
Peak A-F Grid Input Voltage (per tube)* -	340	360	390	volts
Max-Signal Peak Driving Power* - - -	340	230	225	watts
Max-Signal Nominal Driving Power* - -	170	115	113	watts
Max-Signal Plate Output Power - -	11,000	11,000	13,000	watts

*Approximate values.

[1] Adjust to give listed zero-signal plate current.

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER "TYPICAL OPERATION", POSSIBLY EXCEEDING THE MAXIMUM RATINGS GIVEN FOR CW SERVICE, WRITE EITEL-McCULLOUGH, INC., FOR INFORMATION AND RECOMMENDATIONS

APPLICATION

▶ **Cooling**—Forced-air cooling must be provided to hold the glass-to-metal seals and the anode cooler core below the maximum rated temperature of 175° C. Although the air requirements stated below are sufficient to maintain rated tube temperatures under many conditions, air in excess of the amounts shown will usually result in longer tube life. At ambient temperatures higher than 20° C., at high altitudes, and at operating frequencies above 30 megacycles, additional air flow must be provided. In all cases, tube temperatures are the criteria which govern air requirements. Surface temperatures may be measured conveniently with the aid of temperature-sensitive paints.

Anode-to-Base Air-Flow				
	Sea Level		10,000 Feet	
Plate Dissipation (Watts)	Air-Flow (CFM)	Pressure Drop (Inches H_2O)	Air-Flow (CFM)	Pressure Drop (Inches H_2O)
2000	58.5	0.8	85.5	1.15
2500	85.5	1.6	125	2.3

Base-to-Anode Air-Flow				
	Sea Level		10,000 Feet	
Plate Dissipation (Watts)	Air-Flow (CFM)	Pressure Drop (Inches H_2O)	Air-Flow (CFM)	Pressure Drop (Inches H_2O)
2000	35.5	0.25	52	0.35
2500	42	0.5	61.5	0.75

Under the same conditions, a minimum air-flow rate of 6 CFM directed into the filament-stem structure between the inner and outer filament terminals is required to maintain the base seals below 175°C.

Simultaneous removal of all power and air (as in the case of a power failure) will not ordinarily injure the tube, but it is not recommended as a standard operating practice.

Filament Voltage—The filament voltage, as measured directly at the tube, should be 7.5 volts with maximum allowable variations due to line fluctuation of from 7.12 to 7.87 volts.

Bias Voltage—There is little advantage in using bias voltages in excess of those given under "Typical Operation" except in certain very specialized applications. Where bias is obtained from a grid resistor, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation.

Plate Voltage — The plate-supply voltage for the 3X2500A3 should not exceed 6000 volts. In most cases there is little advantage in using plate-supply voltages higher than those given under "Typical Operation" for the power output desired.

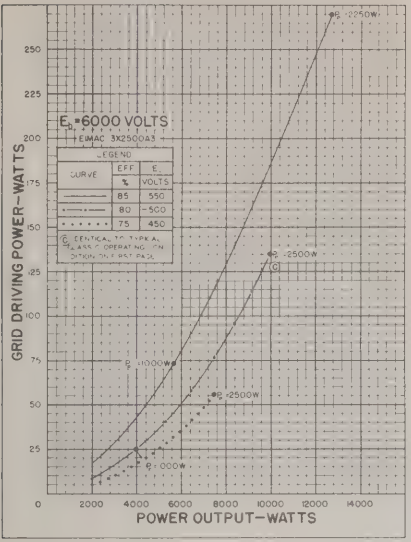
In Class-C FM or Telegraphy service a 0.1 —henry choke, shunted by a spark gap, should be series connected between the plates of the amplifier tubes and the high-voltage plate-supply capacitor to offer protection from transients and surges. In plate-modulated services where a plate-modulation transformer is used the protective choke is not normally required.

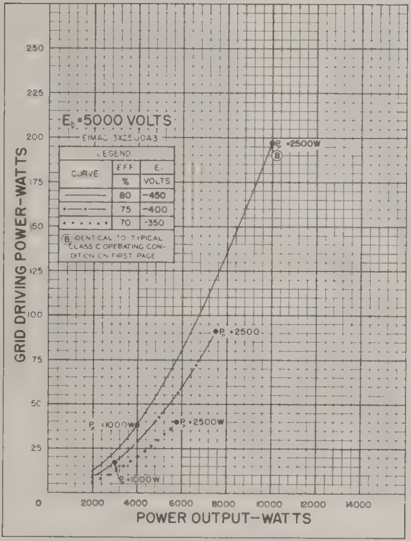
Grid Dissipation—The power dissipated by the grid of the 3X2500A3 must never exceed 150 watts. Grid dissipation is the product of d-c grid current and peak positive grid voltage.

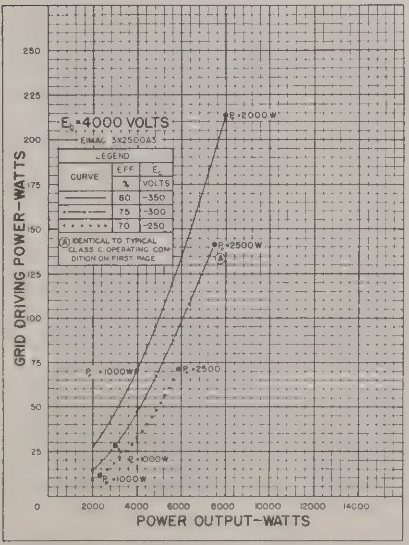
In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading.

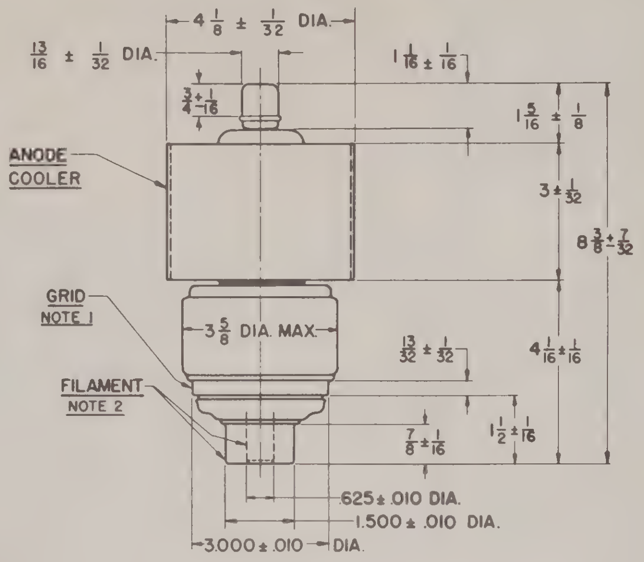
In VHF operation, particularly above 75 Mc., the d-c grid current must not exceed 200 ma. under any conditions of plate loading. With lightly loaded conditions the grid driving power should be reduced so that the grid current does not exceed one-tenth of the plate current.

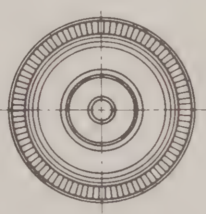
▶ Indicates change from sheet dated 1-1-61









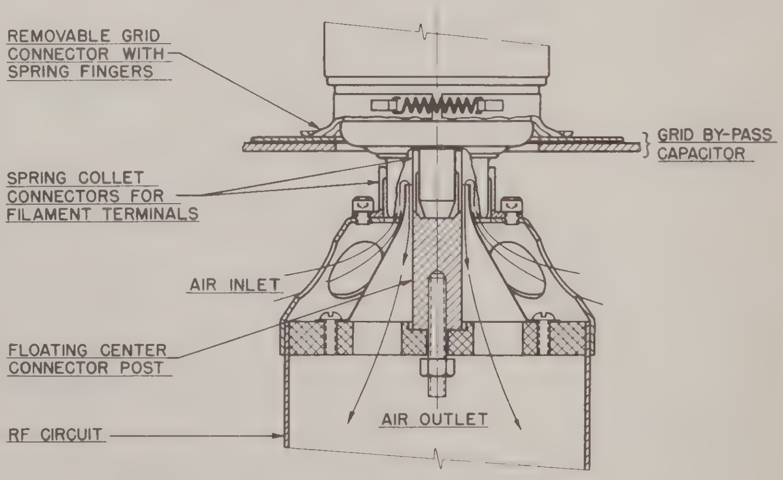


BOTTOM VIEW

NOTE 1
.040" MAXIMUM RUNOUT OF GRID CONTACT SURFACE WITH RESPECT TO AXIS DETERMINED BY ANODE AND OUTER FILAMENT CONTACT SURFACE.

NOTE 2
.025" MAXIMUM RUNOUT OF INNER FILAMENT CONTACT SURFACE WITH RESPECT TO TO OUTER FILAMENT CONTACT SURFACE.

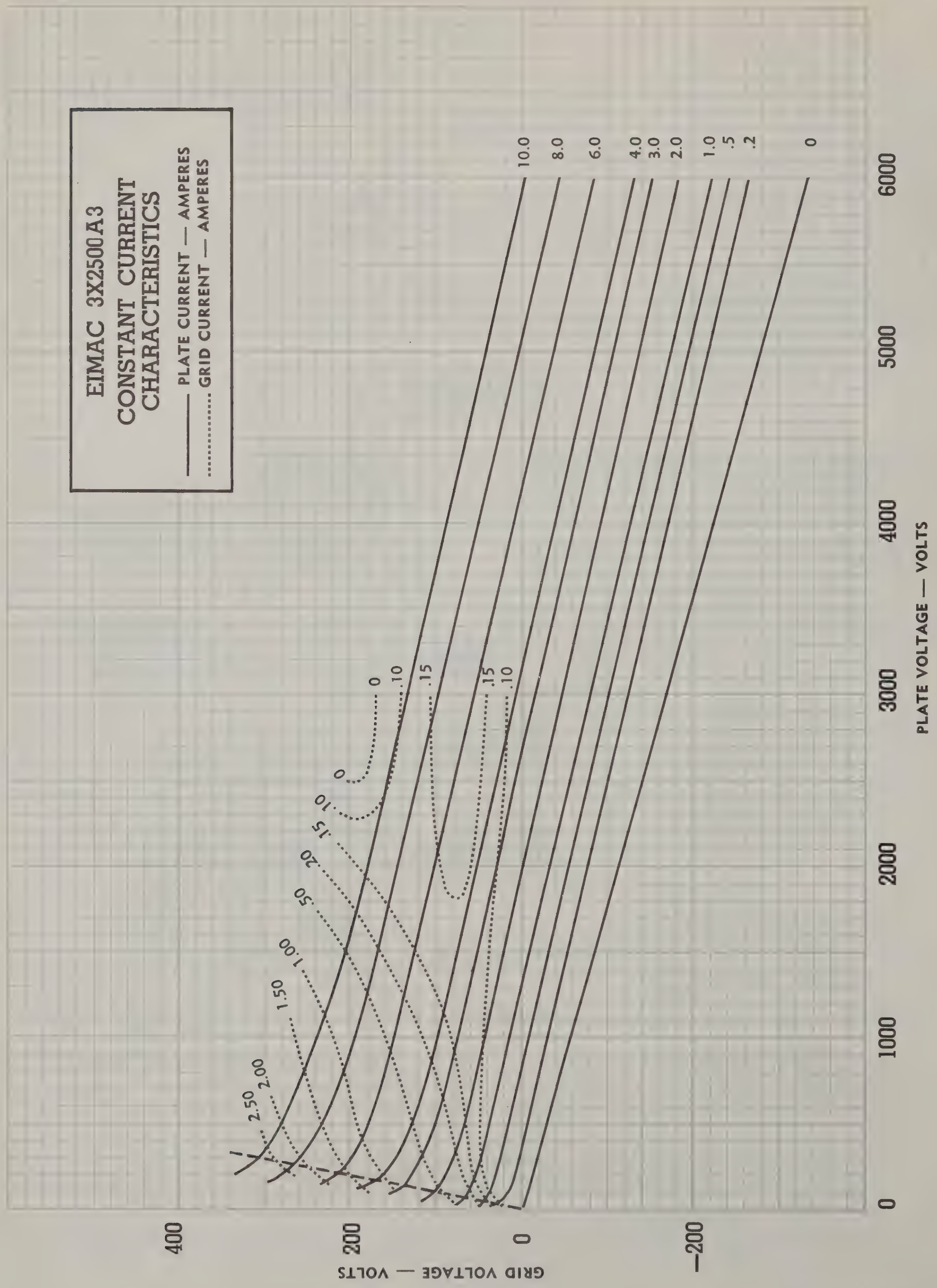
DIMENSIONS IN INCHES


REMOVABLE GRID CONNECTOR WITH SPRING FINGERS
GRID BY-PASS CAPACITOR
SPRING COLLET CONNECTORS FOR FILAMENT TERMINALS
AIR INLET
FLOATING CENTER CONNECTOR POST
AIR OUTLET
RF CIRCUIT

TYPICAL TUBE CONNECTORS AND STEM COOLING

DRIVING POWER vs. POWER OUTPUT

The three charts on this page show the relationship of plate efficiency, power output and approximate grid driving power at plate voltages of 4000, 5000 and 6000 volts. These charts show combined grid and bias losses only. The driving-power and power-output figures do not include circuit losses. The plate dissipation in watts is indicated by Pp. Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 4000, 5000 and 6000 volts respectively.



Printed in U.S.A. 839

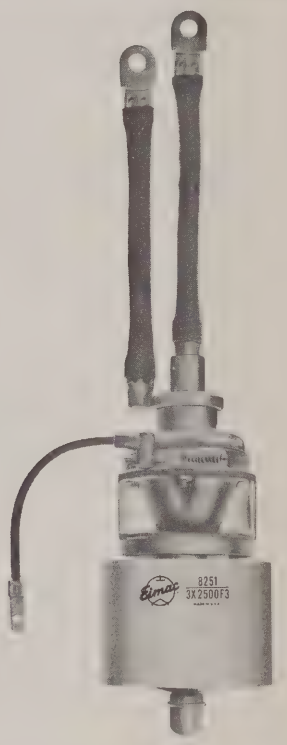
EITEL-McCULLOUGH, INC.
SAN CARLOS, CALIFORNIA

8251
3X2500F3
MEDIUM-MU TRIODE

The Eimac 8251/3X2500F3 is a medium-mu, forced-air cooled, external-anode power triode intended for amplifier, oscillator, or modulator service. It has a maximum plate-dissipation rating of 2500 watts and is capable of high output at relatively low plate voltages. A single 8251/3X2500F3 will deliver a radio-frequency plate power output of 7500 watts at a plate voltage of 4000 volts.

The tube is equipped with flexible filament and grid leads which simplify socketing and equipment design for industrial and communication frequencies below 30 megacycles.

The approved Federal Communications Commission rating for the 8251/3X2500F3 is 5000 watts of carrier power when used as a plate-modulated amplifier and 1250 watts of carrier power when used as a grid-modulated or linear amplifier.



GENERAL CHARACTERISTICS

ELECTRICAL

	Min.	Nom.	Max.	
Filament: Thoriated Tungsten				
Voltage		7.5		volts
Current	49		54	amperes
Amplification Factor	19		26	
Direct Interelectrode Capacitances:				
Grid-Plate	16.8		23.2	uuf
Grid-Filament	29.2		40.2	uuf
Plate-Filament	0.6		1.2	uuf
Transconductance (I_b=830 ma., E_b=3000 v.)		20,000		umhos
Highest Frequency for Maximum Ratings			30	mc

MECHANICAL

Base	See outline drawing
Mounting	Vertical, base down or up
▶ Maximum Anode Cooler Core and Seal Temperatures	175° C
Cooling	Forced air
Maximum Over-All Dimensions:	
Length (Does not include filament connectors)	8.6 inches
Diameter	4.16 inches
Length of Filament Connectors	7 inches
Net Weight	7.5 pounds
Shipping Weight (Approximate)	17 pounds

RADIO-FREQUENCY POWER AMPLIFIER OR OSCILLATOR

Conventional Neutralized Amplifier,
Class-C FM or Telegraphy (Key-Down Conditions)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	6000 MAX. VOLTS
D-C PLATE CURRENT	2.5 MAX. AMPS
PLATE DISSIPATION	2500 MAX. WATTS
GRID DISSIPATION	150 MAX. WATTS

TYPICAL OPERATION (Frequencies below 30 Mc)

D-C Plate Voltage	4000	5000	6000	volts
D-C Plate Current	2.5	2.5	2.08	amps
D-C Grid Voltage	—300	—450	—500	volts
D-C Grid Current	245	265	180	ma
Peak R-F Grid Input Voltage*	580	750	765	volts
Driving Power*	142	197	136	watts
Grid Dissipation*	68	78	46	watts
Plate Input Power	10,000	12,500	12,500	watts
Plate Dissipation	2500	2500	2500	watts
Plate Output Power	7500	10,000	10,000	watts

*Approximate values.

PLATE-MODULATED RADIO-FREQUENCY AMPLIFIER

Conventional Neutralized Amplifier,
Class-C Telephony (Carrier Conditions)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	5000 MAX. VOLTS
D-C PLATE CURRENT	2.0 MAX. AMPS
PLATE DISSIPATION	1670 MAX. WATTS
GRID DISSIPATION	150 MAX. WATTS

TYPICAL OPERATION (Frequencies below 30 Mc)

D-C Plate Voltage	4000	4500	5000	volts
D-C Plate Current	1.67	1.47	1.25	amps
D-C Grid Voltage	—450	—500	—550	volts
D-C Grid Current*	180	140	150	ma
Peak R-F Grid Input Voltage*	685	715	760	volts
Driving Power*	125	100	115	watts
Grid Dissipation*	43	30	32	watts
Plate Input Power	6670	6615	6250	watts
Plate Dissipation	1670	1315	950	watts
Plate Output Power	5000	5300	5300	watts

*Approximate values.

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▶ Indicates change from sheet dated 5-27-59

AUDIO-FREQUENCY POWER AMPLIFIER OR MODULATOR

Class-AB or B

MAXIMUM RATINGS

D-C PLATE VOLTAGE	6000 MAX. VOLTS
D-C PLATE CURRENT	2.5 MAX. AMPS
PLATE DISSIPATION	2500 MAX. WATTS
GRID DISSIPATION	150 MAX. WATTS

TYPICAL OPERATION (Sinusoidal wave, two tubes unless noted)

D-C Plate Voltage	4000	5000	6000 volts
D-C Grid Voltage[1]	—150	—190	—240 volts
Zero-Signal D-C Plate Current	0.6	0.5	0.4 amps
Max-Signal D-C Plate Current	4.0	3.2	3.0 amps
Effective Load, Plate to Plate	2200	3600	4650 ohms
Peak A-F Grid Input Voltage (per tube)*	340	360	390 volts
Max-Signal Peak Driving Power*	340	230	225 watts
Max-Signal Nominal Driving Power*	170	115	113 watts
Max-Signal Plate Output Power	11,000	11,000	13,000 watts

*Approximate values.

[1] Adjust to give listed zero-signal plate current.

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER "TYPICAL OPERATION", POSSIBLY EXCEEDING THE MAXIMUM RATINGS GIVEN FOR CW SERVICE, WRITE EITEL-McCULLOUGH, INC., FOR INFORMATION AND RECOMMENDATIONS

APPLICATION

Cooling—Forced-air cooling must be provided to hold the glass-to-metal seals and the anode cooler core below the maximum rated temperature of 175° C. Although the air requirements stated below are sufficient to maintain rated tube temperatures under many conditions, air in excess of the amounts shown will usually result in longer tube life, At ambient temperatures higher than 20° C and at high altitudes additional air flow must be provided. In all cases, tube temperatures are the criteria which govern air requirements. Surface temperatures may be measured conveniently with the aid of temperature-sensitive paints.

Anode-to-Base Air-Flow				
	Sea Level		10,000 Feet	
Plate Dissipation (Watts)	Air-Flow (CFM)	Pressure Drop (Inches H_2O)	Air-Flow (CFM)	Pressure Drop (Inches H_2O)
2000	58.5	0.8	85.5	1.15
2500	85.5	1.6	125	2.3

Base-to-Anode Air-Flow				
	Sea Level		10,000 Feet	
Plate Dissipation (Watts)	Air-Flow (CFM)	Pressure Drop (Inches H_2O)	Air-Flow (CFM)	Pressure Drop (Inches H_2O)
2000	35.5	0.25	52	0.35
2500	42	0.5	61.5	0.75

Under the same conditions, a minimum air-flow rate of 6 CFM directed into the filament-stem structure between the inner and outer filament terminals is required to maintain the base seals below 175° C.

Simultaneous removal of all power and air (as in the case of a power failure) will not ordinarily injure the tube, but it is not recommended as a standard operating practice.

Filament Voltage—The filament voltage, as measured directly at the tube, should be 7.5 volts with maximum allowable variations due to line fluctuation of from 7.12 to 7.87 volts.

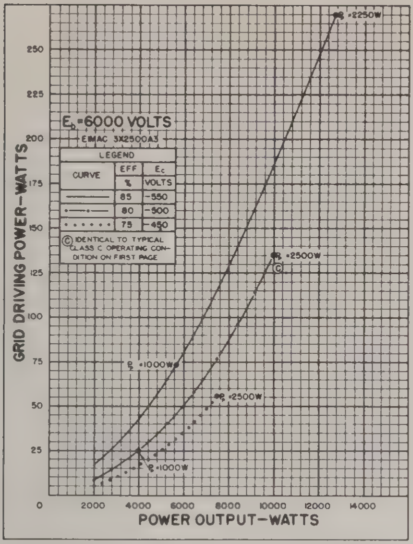
Bias Voltage—There is little advantage in using bias voltages in excess of those given under "Typical Operation," except in certain very specialized applications. Where bias is obtained from a grid resistor, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation.

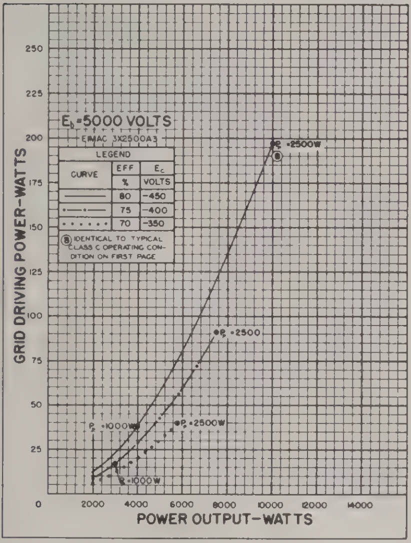
Plate Voltage — The plate-supply voltage for the 3X2500F3 should not exceed 6000 volts. In most cases there is little advantage in using plate-supply voltages higher than those given under "Typical Operation" for the power output desired.

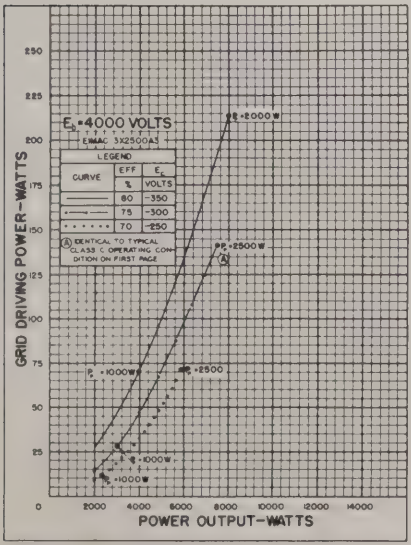
In Class-C FM or Telegraphy service, a 0.1-henry choke, shunted by a spark gap, should be series connected between the plates of the amplifier tubes and the high-voltage plate-supply capacitor to offer protection from transients and surges. In plate-modulated service, where a plate-modulation transformer is used, the protective choke is not normally required.

Grid Dissipation—The power dissipated by the grid of the 3X2500F3 must never exceed 150 watts. Grid dissipation is the product of dc grid current and peak positive grid voltage.

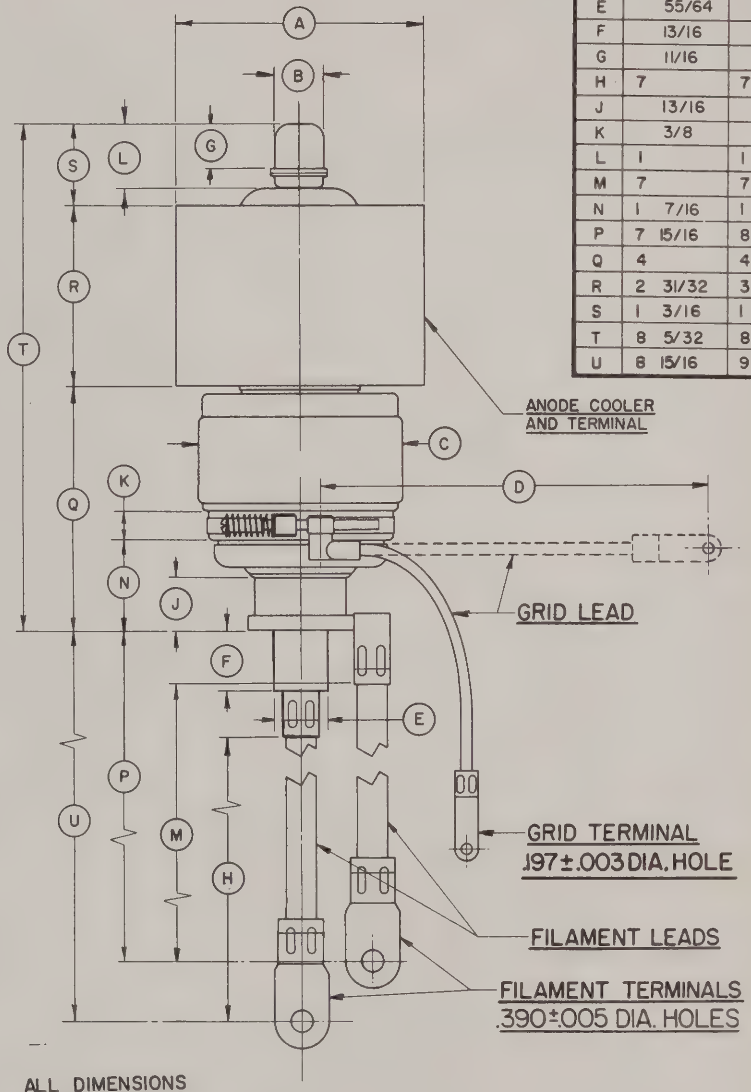
In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading. With lightly loaded conditions the grid driving power should be reduced so that the grid current does not exceed one-tenth of the plate current.







DIMENSION DATA		
REF.	MIN	MAX
A	4 3/32	4 5/32
B	25/32	27/32
C		3 5/8
D	6 3/8	6 5/8
E	55/64	57/64
F	13/16	15/16
G	11/16	13/16
H	7	7 1/2
J	13/16	15/16
K	3/8	7/16
L	1	1 1/8
M	7	7 1/2
N	1 7/16	1 9/16
P	7 15/16	8 7/16
Q	4	4 1/8
R	2 31/32	3 1/32
S	1 3/16	1 7/16
T	8 5/32	8 19/32
U	8 15/16	9 7/16



ALL DIMENSIONS IN INCHES

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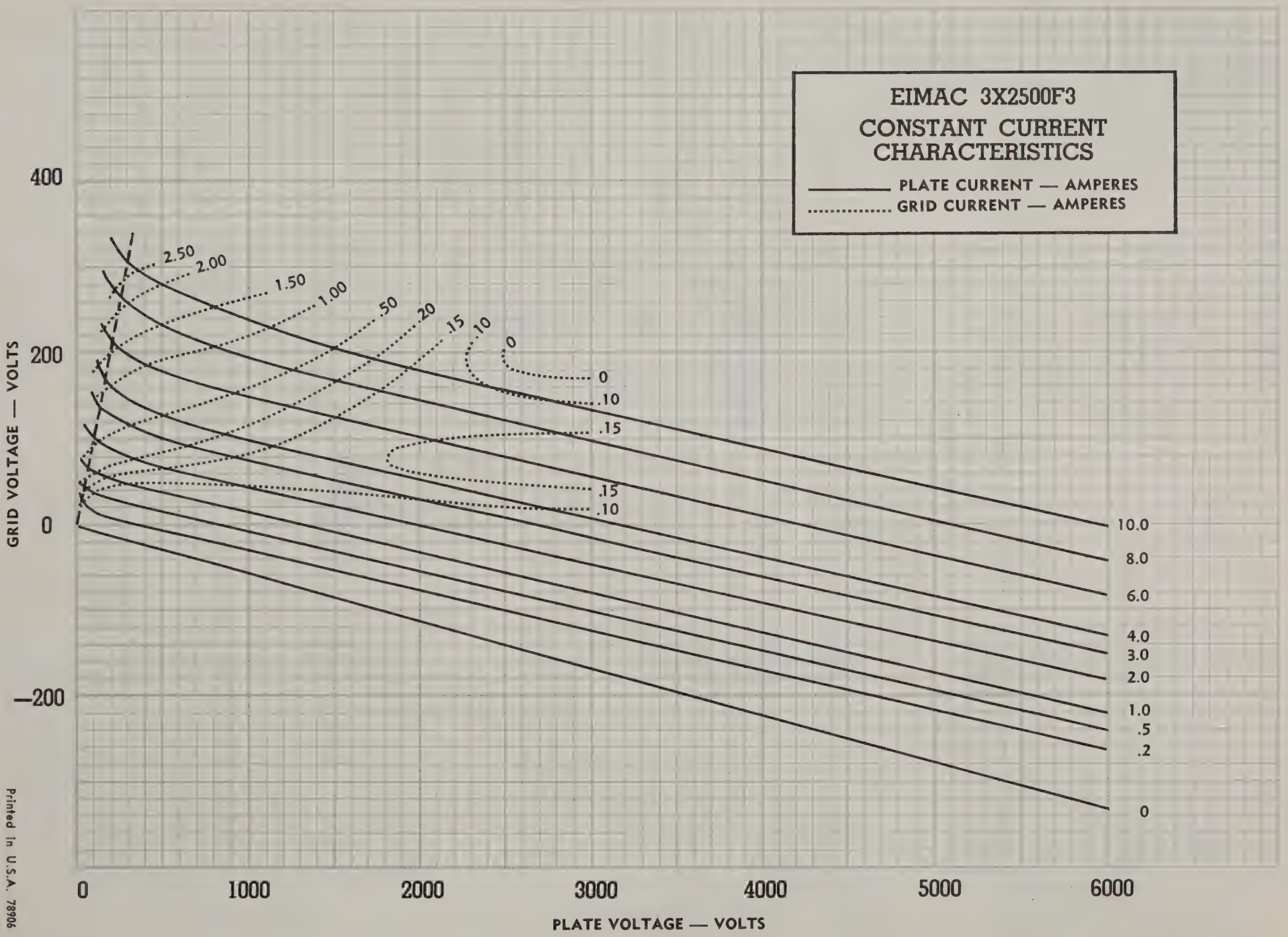
▶ Indicates change from sheet dated 1-27-58


EIMAC 3X2500F3
CONSTANT CURRENT CHARACTERISTICS
PLATE CURRENT — AMPERES
GRID CURRENT — AMPERES
2.50
2.00
1.50
1.00
.50
.20
.15
.10
0
0
.10
.15
.15
.10
10.0
8.0
6.0
4.0
3.0
2.0
1.0
.5
.2
0
400
200
0
—200
GRID VOLTAGE — VOLTS
0
1000
2000
3000
4000
5000
6000
PLATE VOLTAGE — VOLTS

Eimac®

EITEL-McCULLOUGH, INC.
SAN CARLOS, CALIFORNIA

8238
3X3000A1

LOW-MU TRIODE

The Eimac 8238/3X3000A1 is a low-mu forced-air cooled power triode intended for use as an audio amplifier or modulator. The maximum rated plate dissipation is 3000 watts.

Two 3X3000A1's in class-AB_1 audio service will deliver up to 10 kilowatts maximum-signal plate output power at 6000 plate volts without drawing grid current.

The 3X3000A1 is provided with a low inductance, coaxial filament structure. A water-cooled version, the 3W5000A1, rated at 5 kW plate dissipation, is also available.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten	Min.	Nom.	Max.	
Voltage		7.5		volts
Current	49		54	amperes
Amplification Factor	4.4		5.6	
Direct Interelectrode Capacitances (Average)				
Grid-Plate		17		uufd
Grid-Filament		29		uufd
Plate-Filament		2.5		uufd
Transconductance (I_b = 1.0 amp., E_b = 3000 V)		11,000		umhos
Maximum Frequency			75	Mc

MECHANICAL

Base	See outline drawing
Mounting Position	Vertical, base down or up
Cooling	Forced air
▶ Maximum Temperatures:	
Grid and Filament Seals	175°C
Anode Cooler Core	250°C
Maximum Diameter	4.16 inches
Maximum Height	8.59 inches
Net Weight	6.25 pounds
Shipping Weight	16 pounds

AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR

Class-AB_1

MAXIMUM RATINGS (Per tube)

DC PLATE VOLTAGE	6000	MAX.	VOLTS
DC PLATE CURRENT	2.5	MAX.	AMPERES
PLATE DISSIPATION	3000	MAX.	WATTS
GRID DISSIPATION	50	MAX.	WATTS

*Adjust to stated Zero-Signal DC Plate Current. Can be expected to vary ±15%. Effective grid-circuit resistance must not exceed 200,000 ohms.

**At maximum signal without negative feedback.

TYPICAL OPERATION (Sinusoidal wave, two tubes)
Class AB_1

DC Plate Voltage	4000	5000	6000	volts
DC Grid Voltage (Approx)*	-860	-1080	-1300	volts
Zero-Signal DC Plate Current	500	400	335	mA
Max-Signal DC Plate Current	3.00	2.80	2.65	amps
Effective Load, Plate-to-Plate	2160	3320	4560	ohms
Peak AF Grid Input Voltage (per tube)	760	995	1250	volts
Max-Signal Driving Power	0	0	0	watts
Max-Signal Plate Input Power	12.000	14,000	16,000	watts
Max-Signal Plate Dissipation (per tube)	3000	3000	3000	watts
Max-Signal Plate Output Power	6000	8000	10.000	watts
Total Harmonic Distortion**	1.8	2.6	2.1	percent

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▶ Change from data sheet dated 2-1-52

APPLICATION

MECHANICAL

Mounting: The 3X3000A1 must be mounted vertically with its base up or down at the convenience of the designer. The filament connections should be made through spring collets and care must be taken not to impart strain to the terminals or base assembly.

The tube must be protected from severe shock and vibration during shipment and operation.

Cooling: Sufficient forced air cooling must be provided to maintain seal and anode core temperature at 175°C or below. Air-flow must be started when filament power is applied and it is advisable to continue air-cooling for two minutes after all voltages are removed.

The table below lists minimum air-flow requirements to maintain tube temperatures below 175°C with air flowing in both the base-to-anode and anode-to-base directions. This tabulation presumes air at 25° C and sea level. A separate supply of approximately six cubic feet per minute, directed into the filament structure is also required to maintain rated filament seal temperatures. This is best accomplished using a small diameter insulating tubing directed into the stem between the filament seals.

	MINIMUM COOLING AIR-FLOW REQUIREMENTS			
	BASE-TO-ANODE FLOW		ANODE-TO-BASE FLOW	
Plate Dissipation (Watts)	AIR-FLOW (CFM)	PRESSURE DROP (inches of water)	AIR-FLOW (CFM)	PRESSURE DROP (inches of water)
1000	14	0.1	20	0.1
2000	37	0.3	61	0.8
3000	74	1.0	122	3.0

Note:

An extra 425 watts have been added to these plate dissipation figures in preparing this tabulation, to compensate for grid and filament dissipation.

For operation at high altitudes or higher ambient temperatures, these quantities should be increased. In all cases it is suggested that actual temperatures be measured to insure adequate cooling.

ELECTRICAL

Filament: The rated filament voltage for the 3X3000A1 is 7.5 volts and should not exceed this value by more than five percent if maximum tube life is to be realized. Reduction of filament voltage to about 7.2 volts will actually enhance tube life and provision should be made for this adjustment where the lower emission can be tolerated.

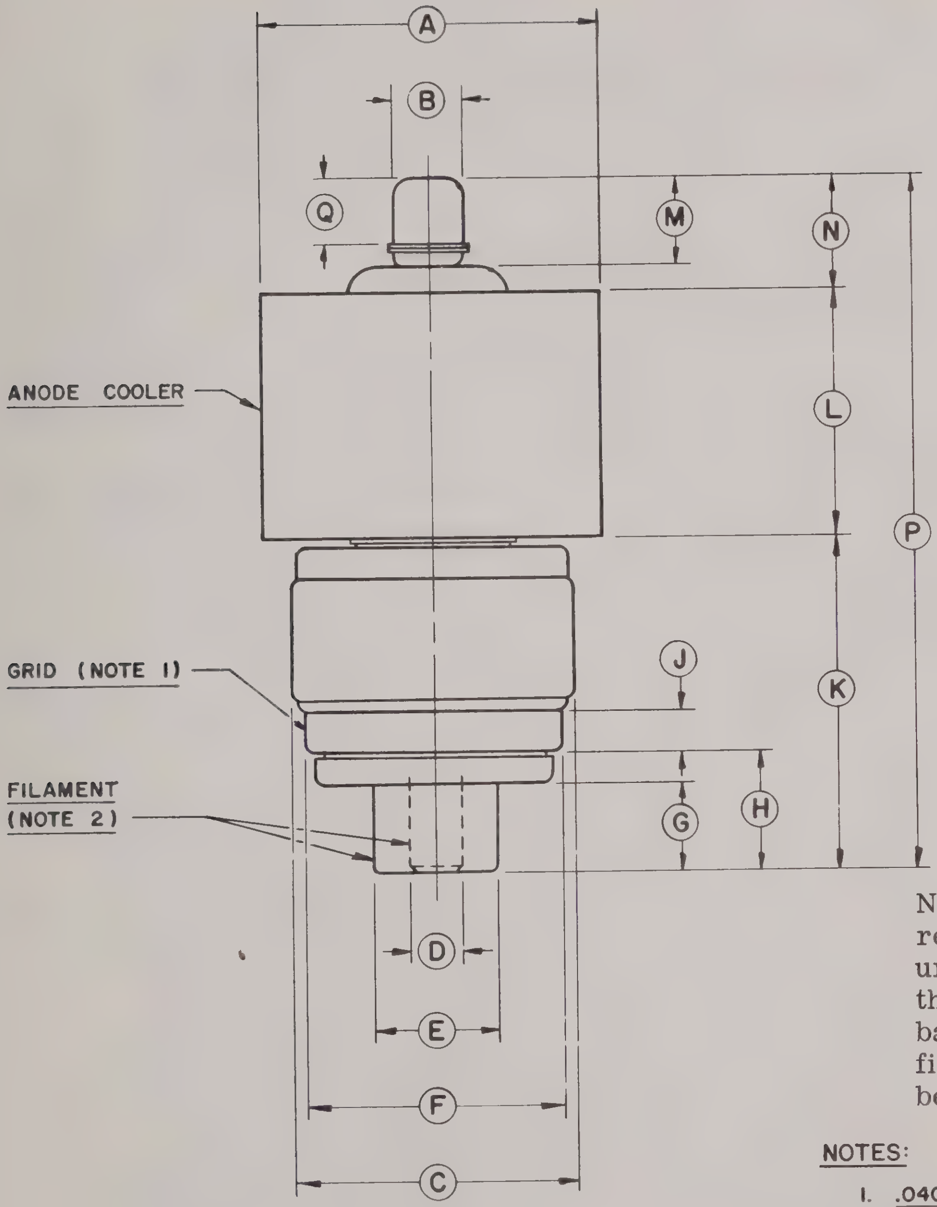
Grid Operation: The grid dissipation rating of the 3X3000A1 is 50 watts. This is the product of the peak positive grid voltage and average dc grid current. When tubes are used in parallel in amplifier or modulator service, provision should be made for individual adjustment of bias voltage, in order to match the tubes. In practice, individual adjustment of drive voltage will not be necessary.

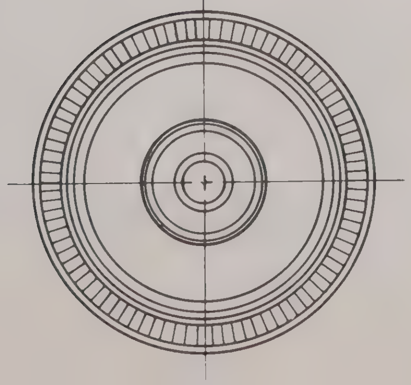
Special Applications: If it is desired to operate the tube under conditions widely different from those given here, write to Power Grid Tube Marketing, Eitel-McCullough, Inc., 301 Industrial Way, San Carlos, California, for information and recommendations.

DIMENSIONS IN INCHES

DIMENSIONAL DATA

REF.	MIN.	MAX.	NOM.
A	4.093	4.156	
B	.781	.843	
C		3.625	
D	.615	.635	
E	1.490	1.510	
F	2.990	3.010	
G	.812	.937	
H	1.437	1.562	
J	.375	.437	
K	4.	4.125	
L	2.968	3.031	
M	1.	1.125	
N	1.187	1.437	
P	8.156	8.593	
Q	.687	.812	

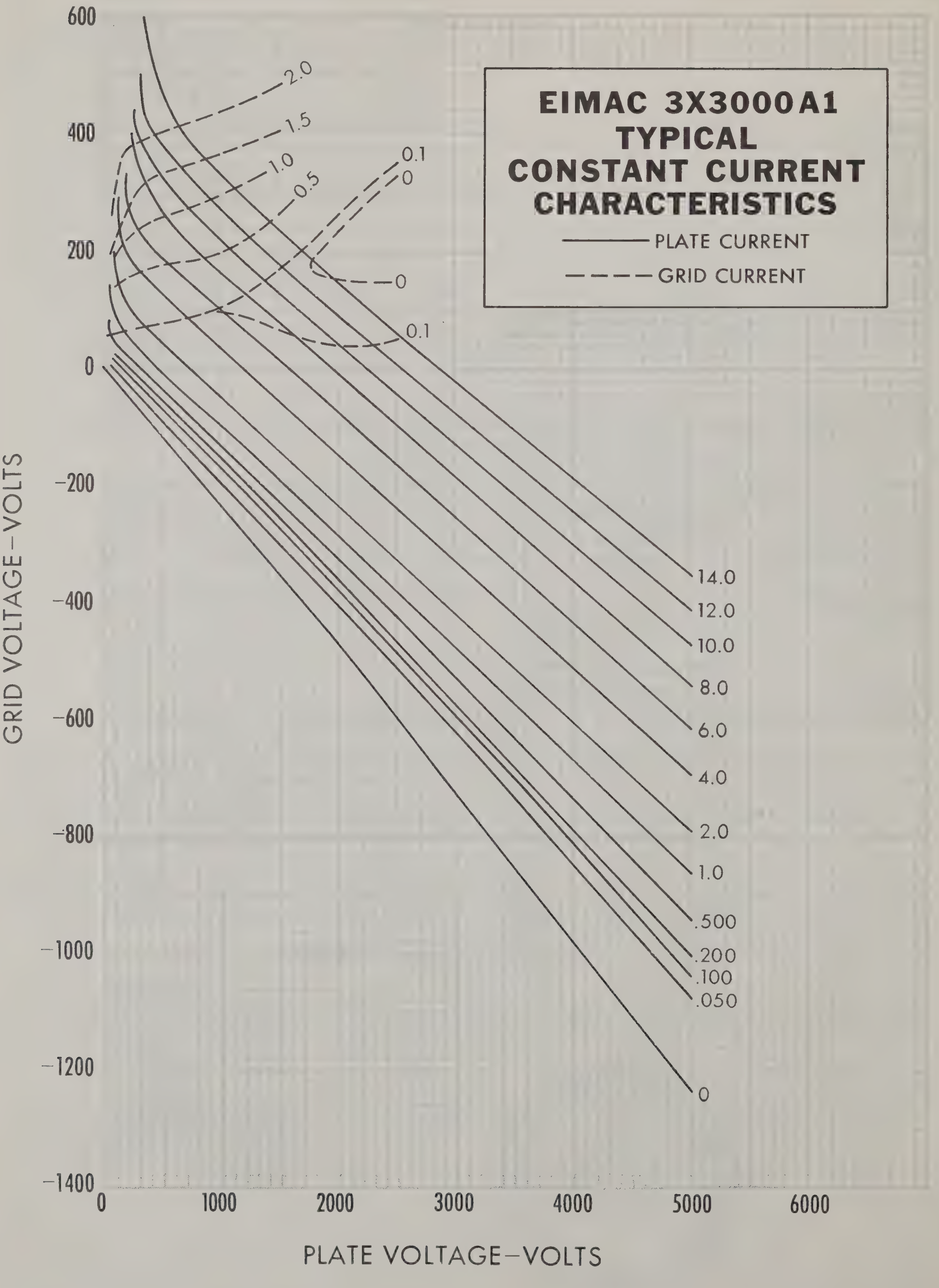




NOTE: These dimensions reflect standard manufacturing tolerances. Where they are to be made the basis of purchase specifications, they should first be checked with the factory.

NOTES:

1. .040 MAX. RUNOUT OF GRID CONTACT SURFACE WITH RESPECT TO AXIS DETERMINED BY ANODE AND OUTER FILAMENT CONTACT SURFACE.
2. .025 MAX. RUNOUT OF INNER FILAMENT CONTACT SURFACE WITH RESPECT TO OUTER FILAMENT CONTACT SURFACE.


EIMAC 3X3000A1
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
PLATE CURRENT
GRID CURRENT
GRID VOLTAGE—VOLTS
PLATE VOLTAGE—VOLTS
600
400
200
0
−200
−400
−600
−800
−1000
−1200
−1400
0
1000
2000
3000
4000
5000
6000
2.0
1.5
1.0
0.5
0.1
0
0
0.1
14.0
12.0
10.0
8.0
6.0
4.0
2.0
1.0
.500
.200
.100
.050
0

Eimac®

EITEL-McCULLOUGH, INC.
SAN CARLOS, CALIFORNIA

TENTATIVE DATA

3X3000A7

HIGH-MU POWER TRIODE

The Eimac 3X3000A7 is an external-anode power triode intended to be used as a zero-bias Class-B amplifier in audio or radio-frequency applications. Operation with zero grid bias offers circuit simplicity by eliminating the bias supply. In addition, grounded-grid operation is attractive since a power gain of over twenty times can be obtained with the 3X3000A7.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated-Tungsten	
Voltage	7.5 volts
Current	51 amperes
Amplification Factor	200
Interelectrode Capacitances:	
Grid-Filament	38 uuf
Grid-Plate	24 uuf
Plate-Filament	0.6 uuf
Frequency for Maximum Ratings	75 Mc

MECHANICAL

Base	See outline drawing
Operating Position	Vertical, base up or down
Cooling	Forced air
Maximum Operating Temperatures:	
Anode Core and Seals	175°C
Maximum Dimensions:	
Height	8.6 inches
Diameter	4.16 inches
Net Weight	6.25 pounds

AF AMPLIFIER OR MODULATOR
CLASS-B, GRID-DRIVEN

MAXIMUM RATINGS (Per Tube)	
DC PLATE VOLTAGE	5000 VOLTS
DC PLATE CURRENT	2.5 AMPS
PLATE DISSIPATION	3 KW
GRID DISSIPATION	225 WATTS

TYPICAL OPERATION, Two Tubes, Sinusoidal Wave	
DC Plate Voltage	4000 volts
DC Grid Voltage	0 volts
Zero-Sig DC Plate Current*	0.640 amps
Max-Sig DC Plate Current	4.00 amps
Max-Sig DC Grid Current	0.860 amps
Driving Power	120 watts
Peak AF Driving Voltage (per tube)	185 volts
Load Resistance, Plate-to-Plate	2200 ohms
Max-Sig Plate Output Power	11,000 watts

*Approximate Values

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RF LINEAR AMPLIFIER
CLASS-B, GROUNDED-GRID

MAXIMUM RATINGS

DC PLATE VOLTAGE	5000 VOLTS
DC PLATE CURRENT	2.5 AMPS
PLATE DISSIPATION	3 KW
GRID DISSIPATION	225 WATTS

*Approximate Value

TYPICAL OPERATION, Single-Tone Conditions

DC Plate Voltage	4000	5000 volts
Zero-Sig DC Plate Current*	0.32	0.44 amps
Max-Sig DC Plate Current	2.00	1.56 amps
Max-Sig DC Grid Current	0.42	0.33 amps
Driving Impedance	50	50 ohms
Resonant Load Impedance	1120	1850 ohms
Max-Sig Driving Power	360	215 watts
Peak Envelope Plate Output Power	5500	5500 watts
Power Gain	15.3	25.6 times

RF LINEAR AMPLIFIER
CARRIER CONDITIONS, GRID-DRIVEN

MAXIMUM RATINGS

DC PLATE VOLTAGE	5000 VOLTS
DC PLATE CURRENT	2.5 AMPS
PLATE DISSIPATION	3 KW
GRID DISSIPATION	225 WATTS

*Approximate Value
†Modulation Crest Conditions

TYPICAL OPERATION

DC Plate Voltage	4000 volts
DC Grid Voltage	0 volts
Zero-Sig DC Plate Current*	0.32 amps
DC Plate Current	0.815 amps
DC Grid Current	0.205 amps
Driving Impedance†	220 ohms
Peak Driving Voltage†	160 volts
Driving Power	15 watts
Plate Output Power	1100 watts

NOTE: "TYPICAL OPERATION" data are obtained by calculation from published characteristic curves and confirmed by direct tests. No allowance for circuit losses, either input or output, has been made.

APPLICATION

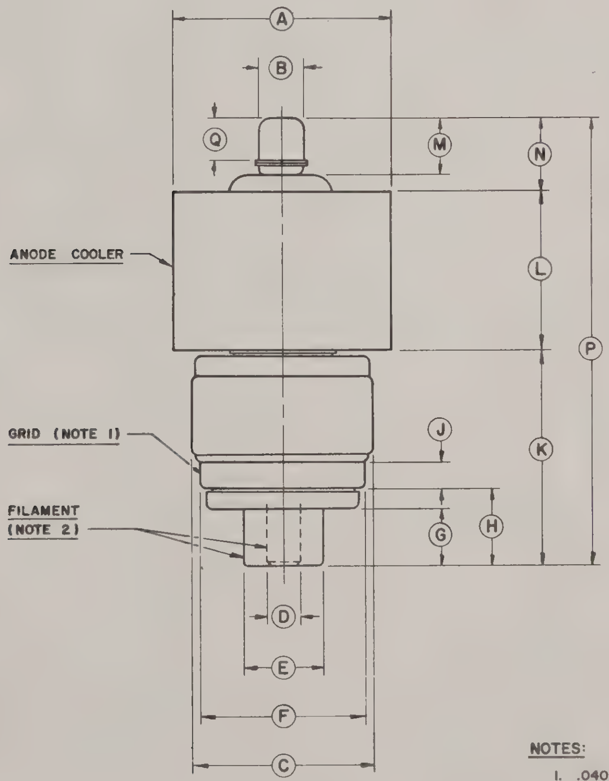
Input Circuit—When the 3X3000A7 is operated as a grounded-grid rf amplifier, the use of a resonant tank in the cathode circuit is recommended in order to obtain greatest linearity and power output. For best results with a single-ended amplifier it is suggested that the cathode tank circuit operate at a "Q" of five or more.

Cooling—The maximum temperature rating for the anode core and seals of the 3X3000A7 is 175°C. Sufficient forced-air cooling must be provided to keep the temperature of the anode core and the temperatures of the glass-to-metal seals below 175°C. Tube life is usually prolonged if these areas are maintained at temperatures below the maximum rating. Minimum air flow requirements to maintain anode-core and seal temperatures below 175°C at sea level with an inlet-air temperature of 50°C are tabulated for air-flow in the anode-to-base and base-to-anode directions. At higher ambient temperatures, frequencies above 30 Mc or at higher altitude, a greater quantity of air will be required. It is suggested that temperatures be monitored in any new installation to insure proper cooling.

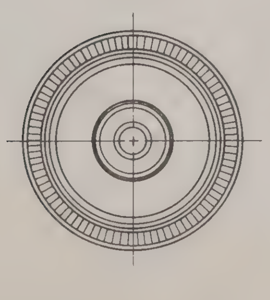
In addition, a minimum air flow of 7 cfm must be directed into the filament stem structure, between the inner and outer filament conductors. This rate of air flow provides sufficient stem cooling at ambient temperatures up to 55°C.

Minimum Cooling Air-Flow Requirements				
	Anode-To-Base Air-Flow		Base-To-Anode Air Flow	
Plate** Dissipation (Watts)	Air Flow (CFM)	Pressure Drop (Inches of Water	Air Flow (CFM)	Pressure Drop (Inches of Water)
1000	42	0.4	25	0.15
2000	109	2.25	63	0.75
3000	215	7.8	130	2.6

**Since the power dissipated by the filament is about 375 watts and since grid dissipation can, under some circumstances, represent another 225 watts, allowance has been made in preparing this tabulation for an additional 600 watts dissipation.

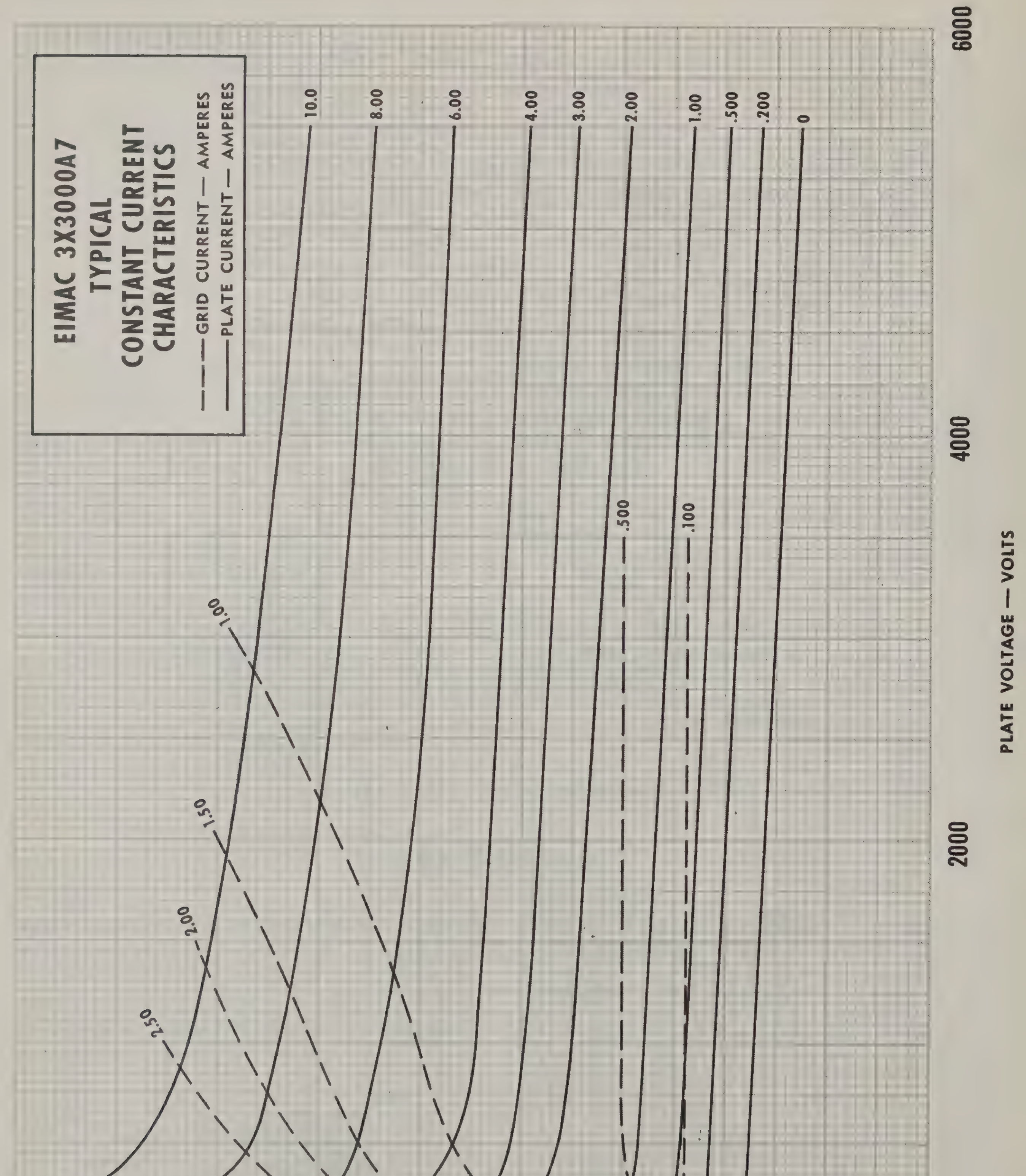


DIMENSIONS IN INCHES			
DIMENSIONAL DATA			
REF.	MIN.	MAX.	NOM.
A	4.093	4.156	
B	.781	.843	
C		3.625	
D	.615	.635	
E	1.490	1.510	
F	2.990	3.010	
G	.812	.937	
H	1.437	1.562	
J	.375	.437	
K	4.	4.125	
L	2.968	3.031	
M	1.	1.125	
N	1.187	1.437	
P	8.156	8.593	
Q	.687	.812	



NOTES:

1. .040 MAX. RUNOUT OF GRID CONTACT SURFACE WITH RESPECT TO AXIS DETERMINED BY ANODE AND OUTER FILAMENT CONTACT SURFACE.
2. .025 MAX. RUNOUT OF INNER FILAMENT CONTACT SURFACE WITH RESPECT TO OUTER FILAMENT CONTACT SURFACE.


EIMAC 3X3000A7
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
GRID CURRENT — AMPERES
PLATE CURRENT — AMPERES
10.0
8.00
6.00
4.00
3.00
2.00
1.00
.500
.200
0
1.00
1.50
2.00
2.50
.500
.100
PLATE VOLTAGE — VOLTS
0
2000
4000
6000
GRID VOLTAGE — VOLTS
300
200
100
0
-100

Eimac

EITEL-McCULLOUGH, INC.
SAN CARLOS, CALIFORNIA

8239
3X3000F1

LOW-MU TRIODE

The Eimac 8239/3X3000F1 is a low-mu forced-air cooled power triode intended for use as an audio amplifier or modulator. The maximum rated plate dissipation is 3000 watts.

Two 3X3000F1's in class-AB_1 audio service will deliver up to 10 kilowatts maximum-signal plate output power at 6000 plate volts without drawing grid current.

The 3X3000F1 is provided with "flying leads" for filament and grid connections.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten	Min.	Nom.	Max.	
Voltage		7.5		volts
Current	49		54	amperes
Amplification Factor	4.4		5.6	
Direct Interelectrode Capacitances (Average)				
Grid-Plate		17		uufd
Grid-Filament		29		uufd
Plate-Filament		2.5		uufd
Transconductance (I_b = 1.0 amp., E_b = 3000 V)		11,000		umhos
Maximum Frequency			30	Mc

MECHANICAL

Base	See outline drawing
Mounting Position	Vertical, base down or up
Cooling	Forced air
▶ Maximum Temperatures:	
Grid and Filament Seals	175°C
Anode Cooler Core	250°C
Maximum Diameter	4.16 inches
Net Weight	7.5 pounds
Shipping Weight	17 pounds

AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR

Class-AB_1

MAXIMUM RATINGS (Per tube)

DC PLATE VOLTAGE	6000 MAX.	VOLTS
DC PLATE CURRENT	2.5 MAX.	AMPERES
PLATE DISSIPATION	3000 MAX.	WATTS
GRID DISSIPATION	50 MAX.	WATTS

*Adjust to stated Zero-Signal DC Plate Current. Can be expected to vary ±15%. Effective grid-circuit resistance must not exceed 200,000 ohms.

**At maximum signal without negative feedback.

TYPICAL OPERATION (Sinusoidal wave, two tubes)
Class AB_1

DC Plate Voltage	4000	5000	6000	volts
DC Grid Voltage (Approx)*	-860	-1080	-1300	volts
Zero-Signal DC Plate Current	500	400	335	mA
Max-Signal DC Plate Current	3.00	2.80	2.65	amps
Effective Load, Plate-to-Plate	2160	3320	4560	ohms
Peak AF Grid Input Voltage (per tube)	760	995	1250	volts
Max-Signal Driving Power	0	0	0	watts
Max-Signal Plate Input Power	12,000	14,000	16,000	watts
Max-Signal Plate Dissipation (per tube)	3000	3000	3000	watts
Max-Signal Plate Output Power	6000	8000	10,000	watts
Total Harmonic Distortion**	1.8	2.6	2.1	percent

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▶ Change from data sheet dated 10-21-59

APPLICATION

MECHANICAL

Mounting: The 3X3000F1 must be mounted vertically with its base up or down at the convenience of the designer. The base is fitted with heavy filament leads to facilitate connections. These leads should be arranged to prevent mechanical stress on the filament structure. The grid is also fitted with a flying lead.

The tube must be protected from severe shock and vibration during shipment and operation.

Cooling: Sufficient forced air cooling must be provided to maintain seal temperature at 175° C or below. Airflow must be started when filament power is applied and it is advisable to continue air-cooling for two minutes after all voltages are removed.

The table below lists minimum air-flow requirements to maintain tube temperatures below 175° C with air flowing in both the base-to-anode and anode-to-base directions. This tabulation presumes air at 25° C and sea level. A separate supply of approximately six cubic feet per minute, directed into the filament structure is also required to maintain rated filament seal temperatures. This is best accomplished using a small diameter insulating tubing directed into the stem, between the filament seals.

	MINIMUM COOLING AIR-FLOW REQUIREMENTS			
	BASE-TO-ANODE FLOW		ANODE-TO-BASE FLOW	
Plate Dissipation (Watts)	AIR-FLOW (CFM)	PRESSURE DROP (inches of water)	AIR-FLOW (CFM)	PRESSURE DROP (inches of water)
1000	14	0.1	20	0.1
2000	37	0.3	61	0.8
3000	74	1.0	122	3.0

Note:

An extra 425 watts have been added to these plate dissipation figures in preparing this tabulation, to compensate for grid and filament dissipation.

For operation at high altitudes or higher ambient temperatures, these quantities should be increased. In all cases it is suggested that actual temperatures be measured to insure adequate cooling.

ELECTRICAL

Filament: The rated filament voltage for the 3X3000F1 is 7.5 volts and should not exceed this value by more than five percent if maximum tube life is to be realized. Reduction of filament voltage to about 7.2 volts will actually enhance tube life and provision should be made for this adjustment where the lower emission can be tolerated.

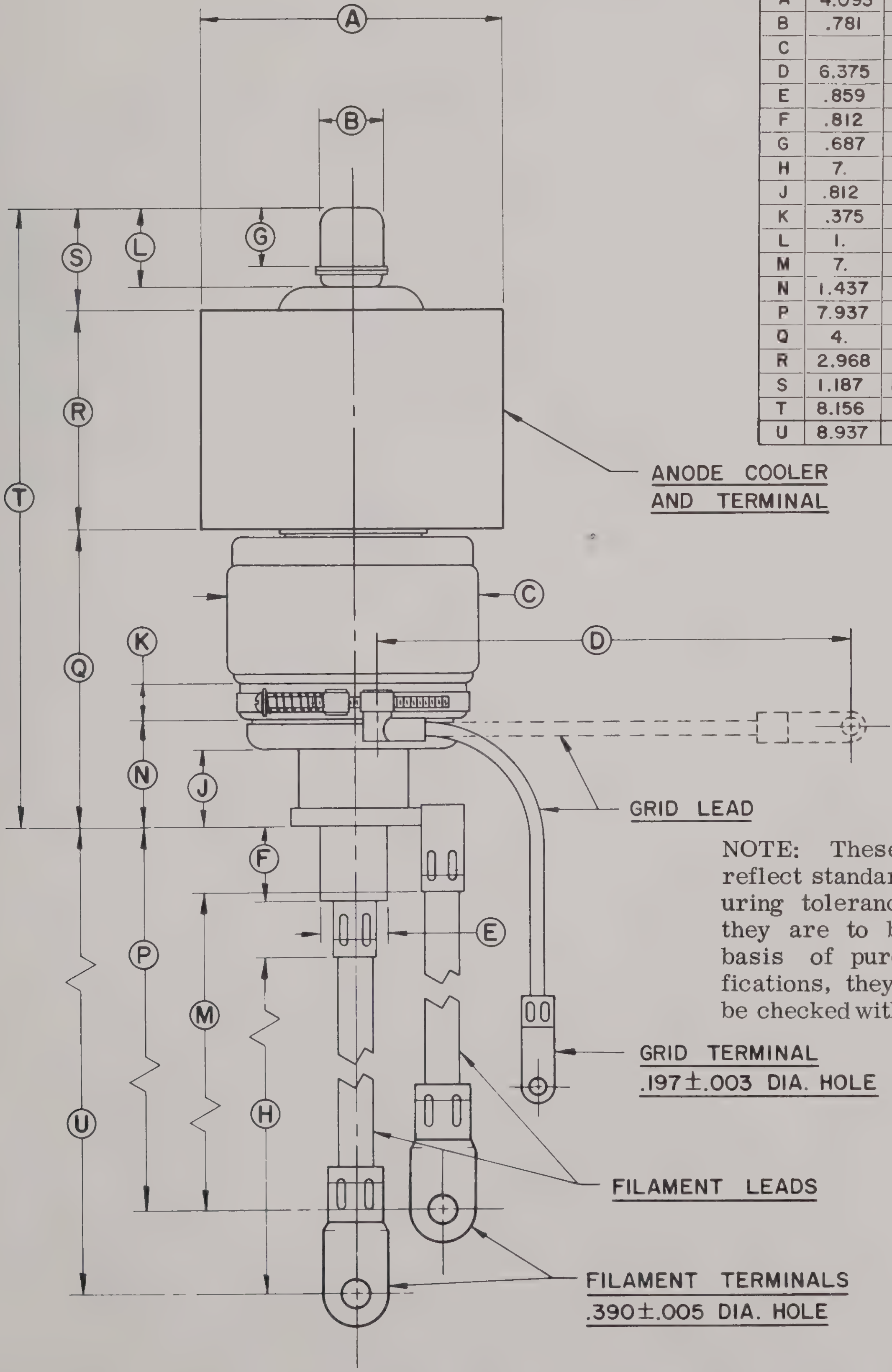
Grid Operation: The grid dissipation rating of the 3X3000F1 is 50 watts. This is the product of the peak positive grid voltage and average dc grid current. When tubes are used in parallel in amplifier or modulator service, provision should be made for individual adjustment of bias voltage, in order to match the tubes. In practice, individual adjustment of drive voltage will not be necessary.

Special Applications: If it is desired to operate the tube under conditions widely different from those given here, write to Power Grid Tube Marketing, Eitel-McCullough, Inc., 301 Industrial Way, San Carlos, California, for information and recommendations.

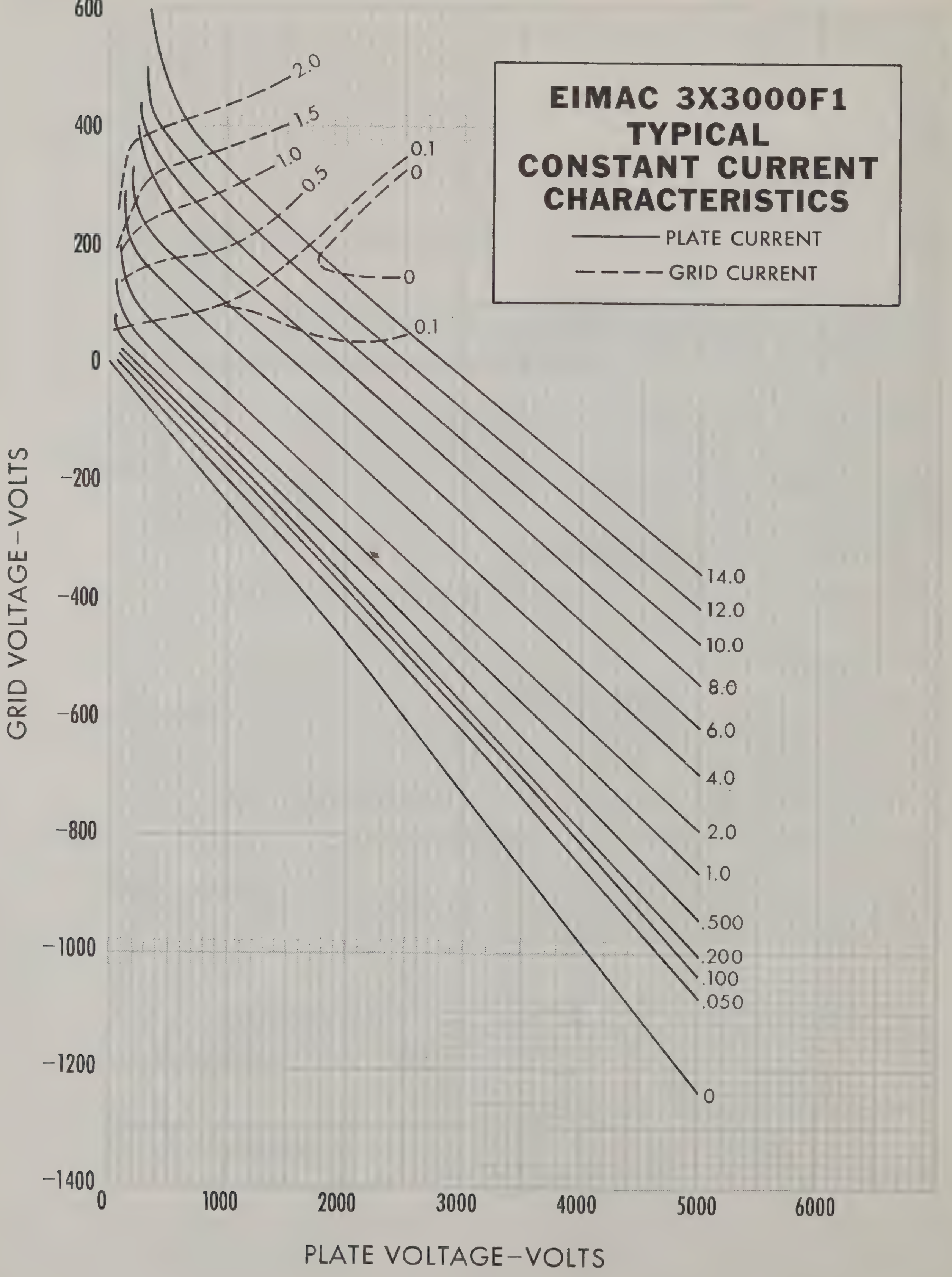
DIMENSIONS IN INCHES

DIMENSIONAL DATA

REF.	MIN.	MAX.	NOM.
A	4.093	4.156	
B	.781	.843	
C		3.625	
D	6.375	6.625	
E	.859	.890	
F	.812	.937	
G	.687	.812	
H	7.	7.500	
J	.812	.937	
K	.375	.437	
L	1.	1.125	
M	7.	7.500	
N	1.437	1.562	
P	7.937	8.437	
Q	4.	4.125	
R	2.968	3.031	
S	1.187	1.437	
T	8.156	8.593	
U	8.937	9.437	


A
B
S
L
G
R
T
ANODE COOLER AND TERMINAL
C
K
D
Q
N
J
GRID LEAD
F
E
P
M
H
U
GRID TERMINAL .197±.003 DIA. HOLE
FILAMENT LEADS
FILAMENT TERMINALS .390±.005 DIA. HOLE

NOTE: These dimensions reflect standard manufacturing tolerances. Where they are to be made the basis of purchase specifications, they should first be checked with the factory.


EIMAC 3X3000F1
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
PLATE CURRENT
GRID CURRENT
GRID VOLTAGE—VOLTS
600
400
200
0
-200
-400
-600
-800
-1000
-1200
-1400
PLATE VOLTAGE—VOLTS
0
1000
2000
3000
4000
5000
6000
2.0
1.5
1.0
0.5
0.1
0
0
0.1
14.0
12.0
10.0
8.0
6.0
4.0
2.0
1.0
.500
.200
.100
.050
0

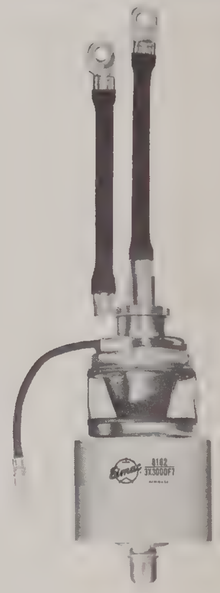
Eimac

EITEL-McCULLOUGH, INC.
SAN CARLOS, CALIFORNIA

TENTATIVE DATA

8162
3X3000F7

HIGH-MU POWER TRIODE



The Eimac 8162/3X3000F7 is an external-anode power triode intended to be used as a zero-bias Class-B amplifier in audio or radio-frequency applications. Operation with zero grid bias offers circuit simplicity by eliminating the bias supply. In addition, grounded-grid operation is attractive since a power gain of over twenty times can be obtained with the 8162/3X3000F7.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated-Tungsten		
Voltage	7.5	volts
Current	51	amperes
Amplification Factor	200	
Interelectrode Capacitances:		
Grid-Filament	38	uuf
Grid-Plate	24	uuf
Plate-Filament	0.6	uuf
Frequency for Maximum Ratings	30	Mc

MECHANICAL

Base	See outline drawing	
Operating Position	Vertical, base up or down	
Cooling	Forced air	
Maximum Operating Temperatures:		
Anode Core and Seals	150°C	
Maximum Dimensions:		
Height (Does not include filament connectors)	8.6	inches
Diameter	4.16	inches
Net Weight	7.5	pounds

A-F AMPLIFIER OR MODULATOR
CLASS-B, GRID-DRIVEN

MAXIMUM RATINGS (Per Tube)	
D-C PLATE VOLTAGE	5000 VOLTS
D-C PLATE CURRENT	2.5 AMPS
PLATE DISSIPATION	3 KW
GRID DISSIPATION	225 WATTS

TYPICAL OPERATION, Two Tubes,
Sinusoidal Wave

D-C Plate Voltage	4000	volts
D-C Grid Voltage	0	volts
Zero-Sig D-C Plate Current*	0.640	amps
Max-Sig D-C Plate Current	4.00	amps
Max-Sig D-C Grid Current	0.860	amps
Driving Power	120	watts
Peak A-F Driving Voltage (per tube)	185	volts
Load Resistance, Plate-to-Plate	2200	ohms
Max-Sig Plate Output Power	11,000	watts

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R-F LINEAR AMPLIFIER CLASS-B, GROUNDED-GRID

MAXIMUM RATINGS	
D-C PLATE VOLTAGE	5000 VOLTS
D-C PLATE CURRENT	2.5 AMPS
PLATE DISSIPATION	3 KW
GRID DISSIPATION	225 WATTS

TYPICAL OPERATION, Single-Tone Conditions

D-C Plate Voltage	4000	5000	volts
Zero-Sig D-C Plate Current*	0.32	0.44	amps
Max-Sig D-C Plate Current	2.00	1.56	amps
Max-Sig D-C Grid Current	0.42	0.33	amps
Driving Impedance	50	50	ohms
Resonant Load Impedance	1120	1850	ohms
Max-Sig Driving Power	360	215	watts
Peak Envelope Plate Output Power	5500	5500	watts
Power Gain	15.3	25.6	times

R-F LINEAR AMPLIFIER CARRIER CONDITIONS, GRID-DRIVEN

MAXIMUM RATINGS	
D-C PLATE VOLTAGE	5000 VOLTS
D-C PLATE CURRENT	2.5 AMPS
PLATE DISSIPATION	3 KW
GRID DISSIPATION	225 WATTS

TYPICAL OPERATION

D-C Plate Voltage	4000	volts
D-C Grid Voltage	0	volts
Zero-Sig D-C Plate Current*	0.32	amps
D-C Plate Current	0.815	amps
D-C Grid Current	0.205	amps
Driving Impedance †	220	ohms
Peak Driving Voltage †	160	volts
Driving Power	15	watts
Plate Output Power	1100	watts

NOTE: "TYPICAL OPERATION" data are obtained by calculation from published characteristic curves and confirmed by direct tests. No allowance for circuit losses, either input or output, has been made.

APPLICATION

INPUT CIRCUIT - When the 3X3000F7 is operated as a grounded-grid r-f amplifier, the use of a resonant tank in the cathode circuit is recommended in order to obtain greatest linearity and power output. For best results with a single-ended amplifier it is suggested that the cathode tank circuit operate at a "Q" of five or more.

COOLING - The maximum temperature rating for the anode core and seals of the 3X3000F7 is 150°C. Sufficient forced-air cooling must be provided to keep the temperature of the anode core and the temperatures of the glass-to-metal seals below 150°C. Tube life is usually prolonged if these areas are maintained at temperatures below the maximum rating. Minimum air flow requirements to maintain anode-core and seal temperatures below 150°C with inlet-air temperatures of 40°C and 55°C are tabulated. A maximum ambient temperature of 40°C will apply to most commercial installations, while the 55°C data is useful when designing equipment in conformance with MIL-E-5400 Curve A (Class I).

In addition, a minimum air flow of 7 CFM must be directed into the filament stem structure, between the inner and outer filament conductors. This rate of air flow provides sufficient stem cooling at ambient temperatures up to 55°C.

---

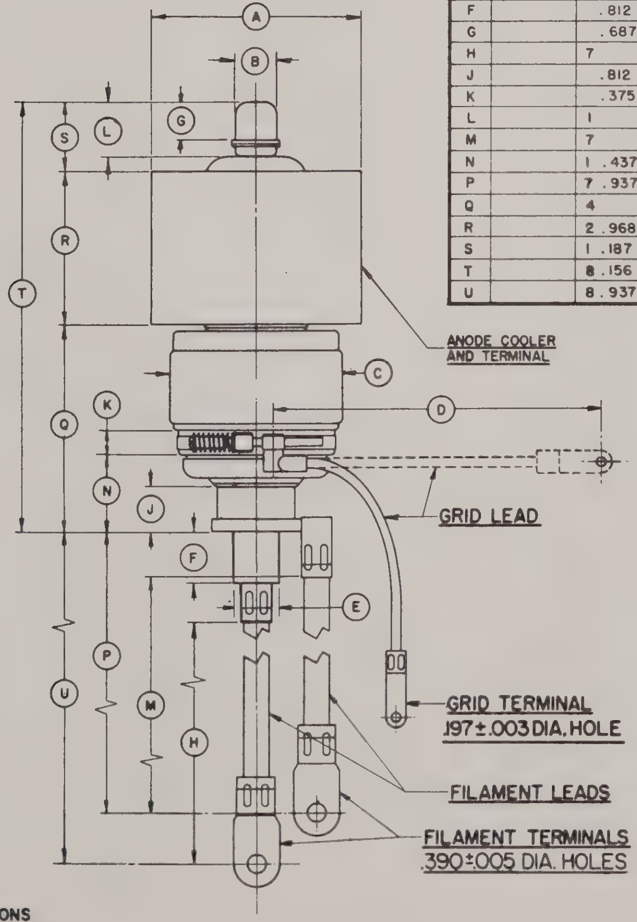
*Approximate Values

†Modulation Crest Conditions

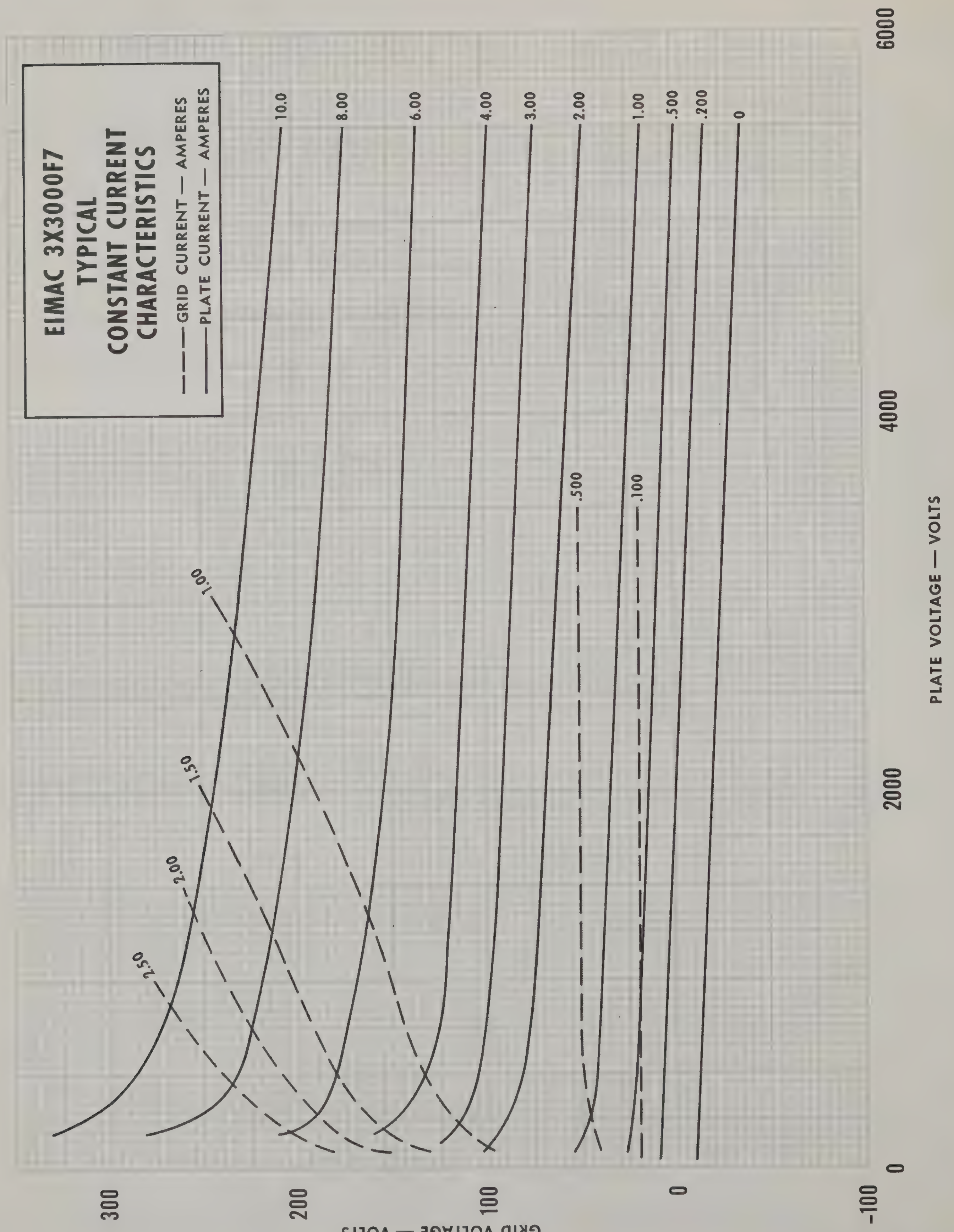
SEA LEVEL PRESSURE, ANODE-TO-BASE AIR FLOW				
	40°C Max Ambient Air Temp.		55°C Max Ambient Air Temp.	
Plate** Dissipation (Watts)	Air Flow (CFM)	Pressure Drop (Inches of Water)	Air Flow (CFM)	Pressure Drop (Inches of Water)
1000	45	0.43	65	0.65
2000	120	1.6	170	2.5
3000	235	4.0	330	6.0

**Since the power dissipated by the filament is about 375 watts and since grid dissipation can, under some circumstances, represent another 225 watts, allowance has been made in preparing this tabulation for an additional 600 watts dissipation.

DIMENSION DATA			
REF.	NOM	MIN	MAX
A		4.093	4.156
B		.781	.843
C			3.625
D		6.375	6.625
E		.859	.890
F		.812	.937
G		.687	.812
H		7	7.500
J		.812	.937
K		.375	.437
L		1	1.125
M		7	7.500
N		1.437	1.562
P		7.937	8.437
Q		4	4.125
R		2.968	3.031
S		1.187	1.437
T		8.156	8.593
U		8.937	9.437


A
B
G
L
S
R
T
ANODE COOLER AND TERMINAL
C
D
K
Q
N
J
GRID LEAD
F
E
P
U
M
H
GRID TERMINAL .197±.003 DIA. HOLE
FILAMENT LEADS
FILAMENT TERMINALS .390±.005 DIA. HOLES

ALL DIMENSIONS IN INCHES


EIMAC 3X3000F7
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
GRID CURRENT — AMPERES
PLATE CURRENT — AMPERES
10.0
8.00
6.00
4.00
3.00
2.00
1.00
.500
.200
0
1.00
1.50
2.00
2.50
.500
.100
PLATE VOLTAGE — VOLTS
0
2000
4000
6000
GRID VOLTAGE — VOLTS
300
200
100
0
-100

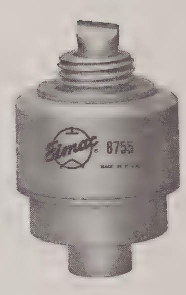
TECHNICAL DATA

8755/8755A

HIGH-MU PLANAR TRIODE

The 8755/8755A is a miniature, ceramic/metal, rugged planar triode for advanced airborne and space applications up to 3.0 GHz.

The 8755/8755A may be used as an amplifier, oscillator, or frequency multiplier in the grid- or plate-pulsed mode, as well as a modulator or regulator tube. In addition to low interelectrode capacitances, high transconductance and amplification factor, the 8755/8755A has an anode designed to produce frequency stability, and an arc-resistant cathode, both assuring stable, reliable and long-life operation under adverse conditions.



The 8755/8755A is supplied without radiator and may be conduction, convection, heat sink, or liquid cooled. Radiators for forced-air cooling, permitting an anode dissipation up to 150 watts, can be furnished on separate order.

The 8755/8755A is especially designed for applications where high rf pulse power is required. It can also be readily used in switch tube applications up to 8 kV dc.

The 8755A is identical to the 8755 in all respects except that the 8755A is furnished with a spewing shield. With this, this tube will exhibit longer life in the same applications and should be used where long tube life is of major concern.

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Cathode: Oxide Coated, Unipotential		
Heater: Voltage	6.3 ± 0.3	V
Current, at 6.3 volts	1.30	A
Transconductance (Average):		
I_b = 160 mA (200 mA/cm^2)	38	mmhos
Amplification Factor (Average):	135	
Direct Interelectrode Capacitances (Grounded Cathode)[2]		
Cgk	9.5	pF
Cpk	0.06	pF
Cgp	1.05	pF
Cut-off Bias[3]	-20	V max.

1. Characteristics and operating values are based upon performance tests. These figures may change without notice as the results of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.

2. Capacitance values for a cold tube as measured in a special shielded fixture. When the cathode is heated to the proper temperature, the grid-cathode capacitance will increase from the cold value by approximately 1 pF due to thermal expansion of the cathode.

3. Measured with one milliampere plate current and a plate voltage of 1 kVdc.

(Revised 6-1-71) © by Varian Printed in U.S.A.

MECHANICAL

Maximum Overall Dimensions:	
Length	1.37 in; 34.75 mm
Diameter	0.785 in; 19.94 mm
Net Weight	0.56 oz; 16 gm
Operating Position	Any
Maximum Operating Temperature:	
Ceramic/Metal Seals	250°C
Anode Core	250°C
Cooling	Conduction, convection, forced-air[1] or liquid
Terminals	Coaxial, special

[1] Using one of the EIMAC radiators shown on the cooling curves.

ENVIRONMENTAL

Shock, 11 ms, non-operating	60 G
Vibration, operating, all axes 55 to 500 Hz	10 G
Altitude, max (in a suitably designed circuit)	70,000 ft.

GRID PULSED OR PLATE PULSED AMPLIFIER OR OSCILLATOR

MAXIMUM RATINGS/ABSOLUTE VALUES

DC PLATE VOLTAGE (GRID PULSED)	8000	VOLTS
PEAK PULSE PLATE VOLTAGE (PLATE PULSED)	10,000	VOLTS
DC GRID VOLTAGE	-200	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
Grid negative to cathode	-700	VOLTS
Grid positive to cathode	150	VOLTS
PULSE PLATE CURRENT	5.0	AMPERES
PULSE GRID CURRENT	2.5	AMPERES
PLATE DISSIPATION[1]	150	WATTS
GRID DISSIPATION	1.5	WATTS
FREQUENCY	3.0	GIGAHERTZ
PULSE DURATION[2]	6	μsec
DUTY FACTOR[2]	.0033	

TYPICAL OPERATION
Grid-Pulsed rf Power Amplifier (1182 MHz)

DC Plate Voltage	1750	Vdc
Peak Plate Current	1.0	a
DC Grid Voltage Approx.	-20	V
Peak Grid Current	1.7	a
Filament Voltage	5.6	V
Useful Power Output (Approx.)	650	w
Plate Efficiency	37%	
RF Input Power	65	w
Gain	10	db

1. Using one of the EIMAC radiators shown on the cooling curves.

2. For application requiring longer pulse duration and/or higher duty cycle consult the nearest Varian Electron Tube and Devices Field Office, or the Product Manager, EIMAC Division of Varian, Salt Lake City, Utah.

PULSE MODULATOR OR PULSE AMPLIFIER SERVICE

MAXIMUM RATINGS/ABSOLUTE VALUES

DC PLATE VOLTAGE	8000	VOLTS
PEAK PLATE VOLTAGE	10,000	VOLTS
DC GRID VOLTAGE	-200	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
Grid negative to cathode	-750	VOLTS
Grid positive to cathode	150	VOLTS
PULSE CATHODE CURRENT	7.5	AMPERES
DC PLATE CURRENT	150	MILLIAMPERES
PLATE DISSIPATION[1]	150	WATTS
GRID DISSIPATION	1.5	WATTS
PULSE DURATION[2]	6	μs
DUTY FACTOR[2]	.0033	
CUT-OFF MU	90	

1. Using one of the EIMAC radiators shown on the cooling curves.
2. For application requiring longer pulse duration and/ or higher duty cycle consult the nearest Varian Electron Tube and Device Field Office, or the Product Manager EIMAC Division of Varian, Salt Lake City, Utah.

RANGE VALUES FOR EQUIPMENT DESIGN

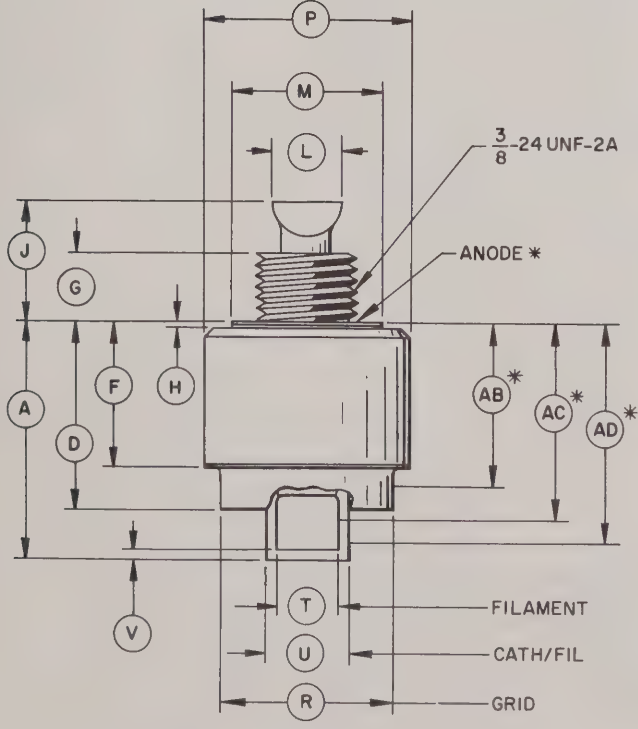
	Min.	Max.	
Heater: Current at 6.3 volts	1.20	1.40	A
Cathode Heating Time	60	---	sec.
Interelectrode Capacitances[1] (grounded cathode connection)			
Cgk	8.5	10.5	pF
Cpk	---	0.06	pF
Cgp	0.9	1.2	pF

1. Capacitance values for a cold tube as measured in a special shielded fixture. When the cathode is heated to the proper temperature, the grid-cathode capacitance will increase from the cold value by approximately 1 pF due to thermal expansion of the cathode.

APPLICATION

COOLING - The 8755/8755A can be cooled by conduction, convection, forced-air or liquid cooling. The tube is designed to permit high-temperature operation up to the limit indicated. However, if long life is the prime objective, tube terminal and seal temperatures should be kept well below 250°C. If forced-air cooling is provided, auxiliary air flow, apart from the air flowing through the radiator, should be provided to cool the tube envelope and other tube terminals. Some conduction cooling is always provided through the contact terminals. However, these terminals usually exhibit poor heat transfer, often having a temperature gradient across them as high as 50°C. Cooling curves are given for the three radiators which are suitable for use with the 8755/8755A.

For further details on cooling or other aspects of tube operation, refer to EIMAC bulletin #15, "Operating Data for Planar Triodes."



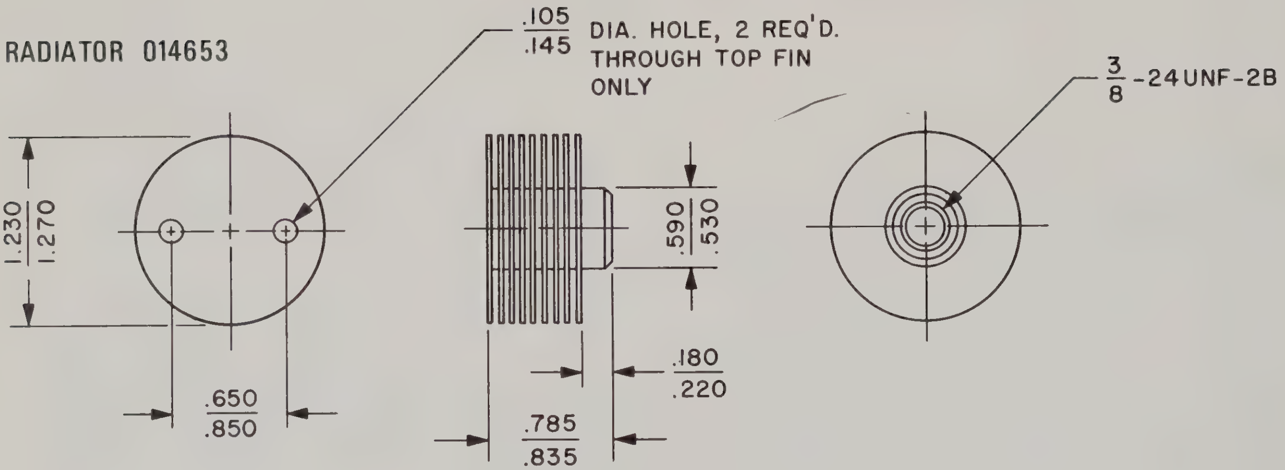
DIMENSIONAL DATA						
DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	- -	1.020	- -	- -	25.91	- -
D	0.740	0.800	- -	18.80	20.32	- -
F	- -	0.570	- -	- -	14.48	- -
G	0.150	0.170	- -	3.81	4.32	- -
H	- -	0.040	- -	- -	1.02	- -
J	- -	0.350	- -	- -	8.89	- -
L	- -	0.260	- -	- -	6.60	- -
M	0.545	0.570	- -	13.84	14.48	- -
P	0.775	0.785	- -	19.69	19.94	- -
R	0.650	0.670	- -	16.51	17.02	- -
T	0.210	0.225	- -	5.33	5.72	- -
U	0.310	0.330	- -	7.87	8.38	- -
V	- -	0.040	- -	- -	1.02	- -
AB	0.590	0.740	- -	14.99	18.80	- -
AC	0.760	0.885	- -	19.30	22.48	- -
AD	0.800	0.975	- -	20.32	24.77	- -

NOTES

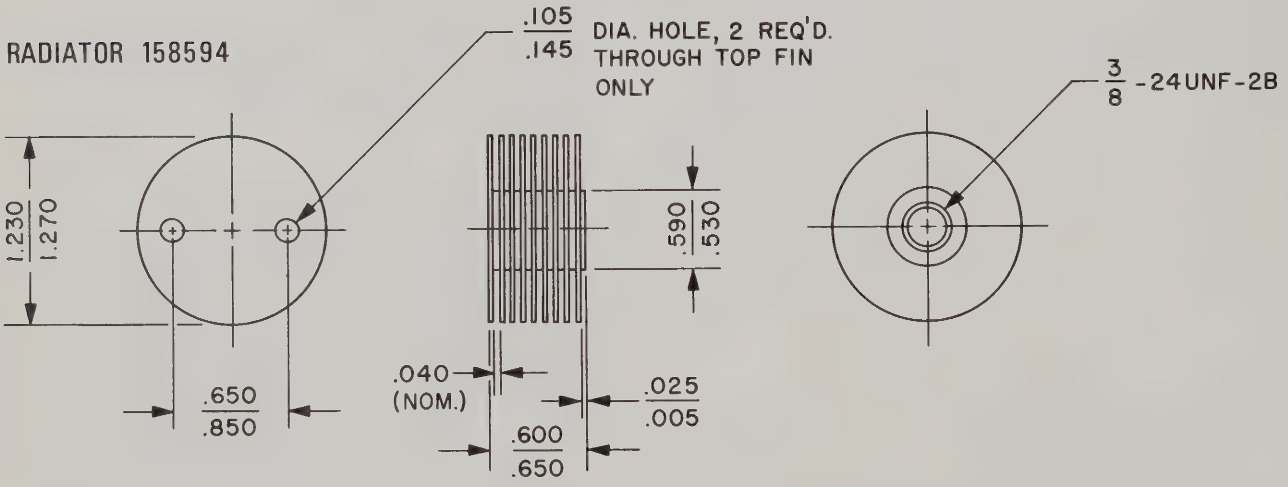
1. REF. DIMS. ARE FOR INFO. ONLY AND ARE NOT REQ'D. FOR INSPECTION PURPOSES.
2. (*) CONTACT SURFACE.
3. ANODE FLANGE IS ELECTRICAL CONTACT. STUD IS FOR HEAT TRANSFER.

EIMAC RADIATORS

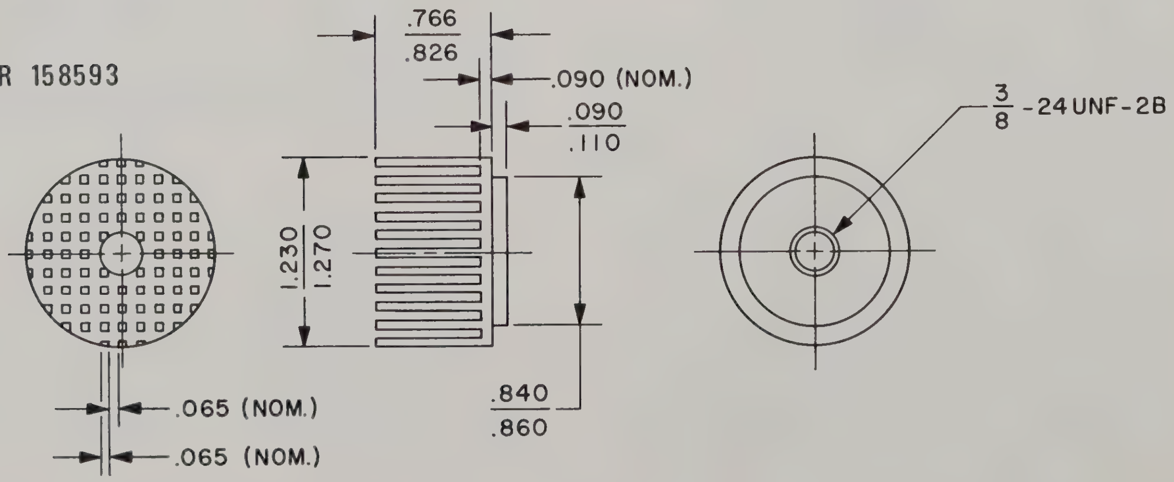
RADIATOR 014653



RADIATOR 158594

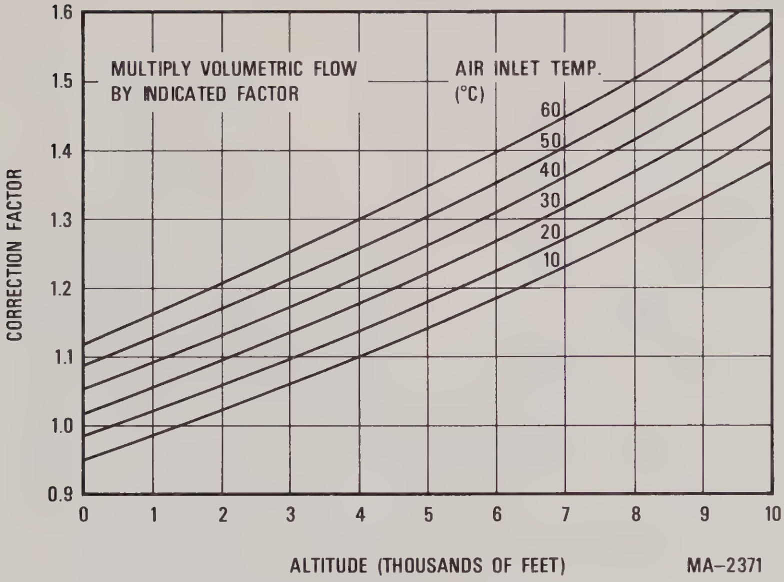


RADIATOR 158593



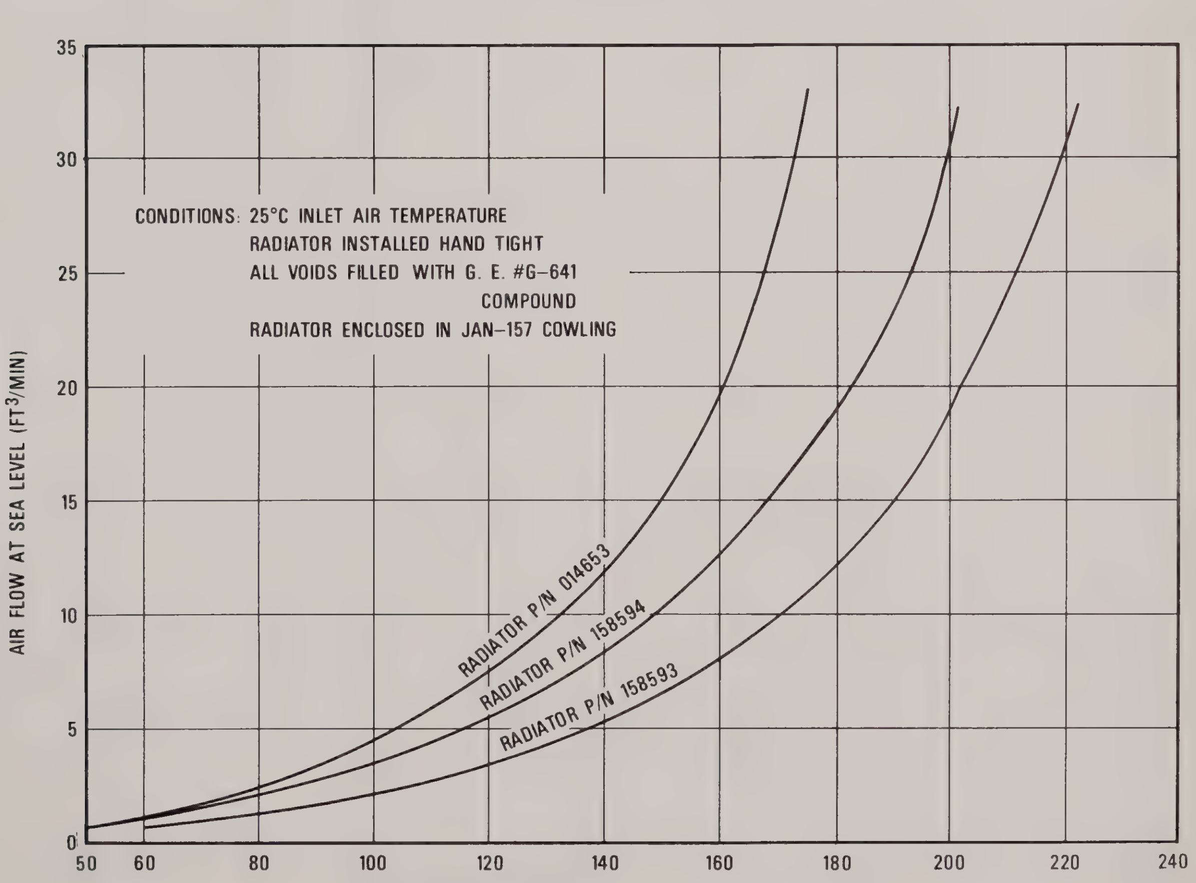
COMBINED CORRECTION FACTORS FOR INLET AIR TEMPERATURE AND ALTITUDE

(RELATIVE TO 25°C AND SEA LEVEL)

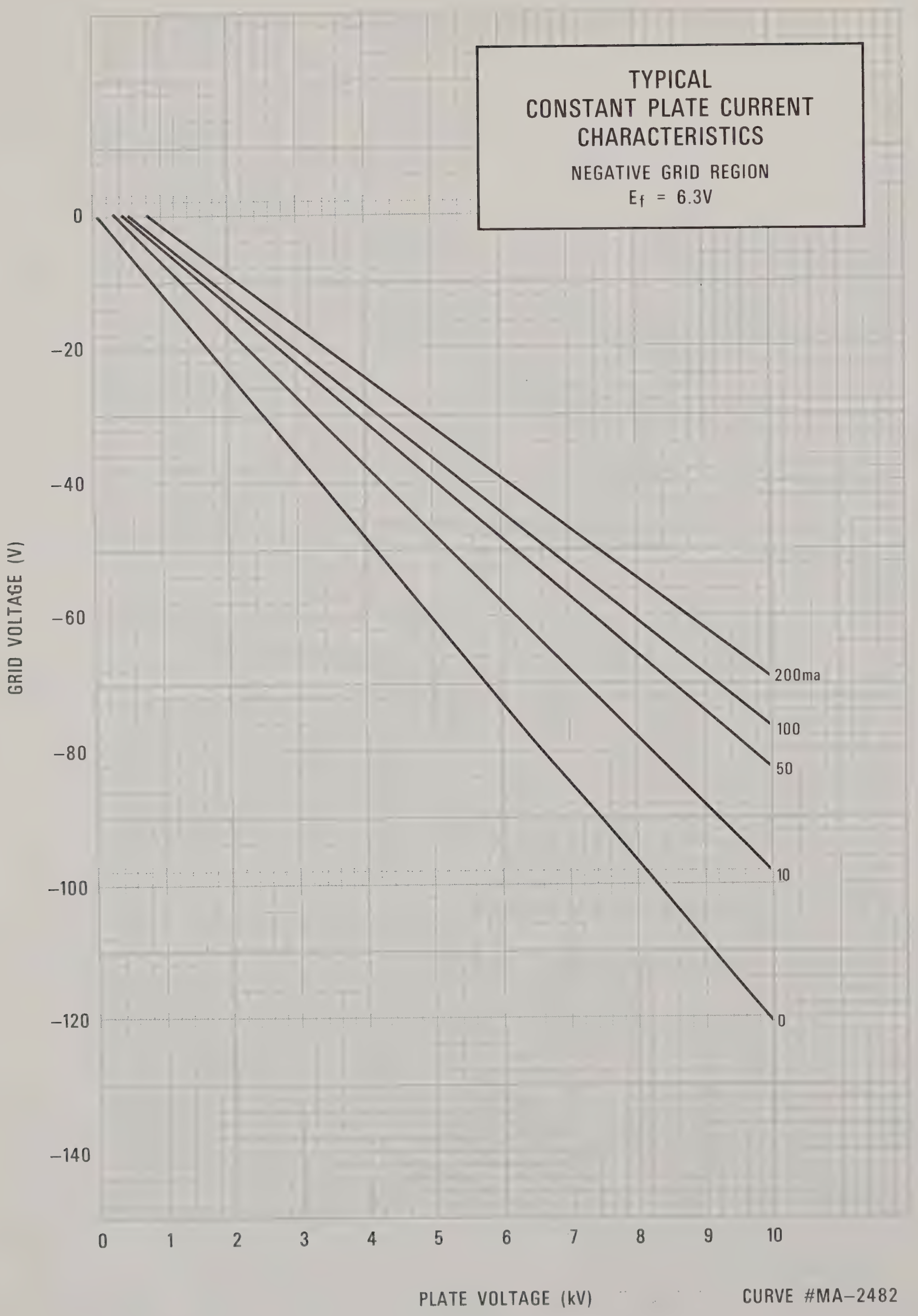


MA–2371

PLATE DISSIPATION VARIATION WITH COOLING AIR FLOW



MA–2370



CURVE #MA–2482

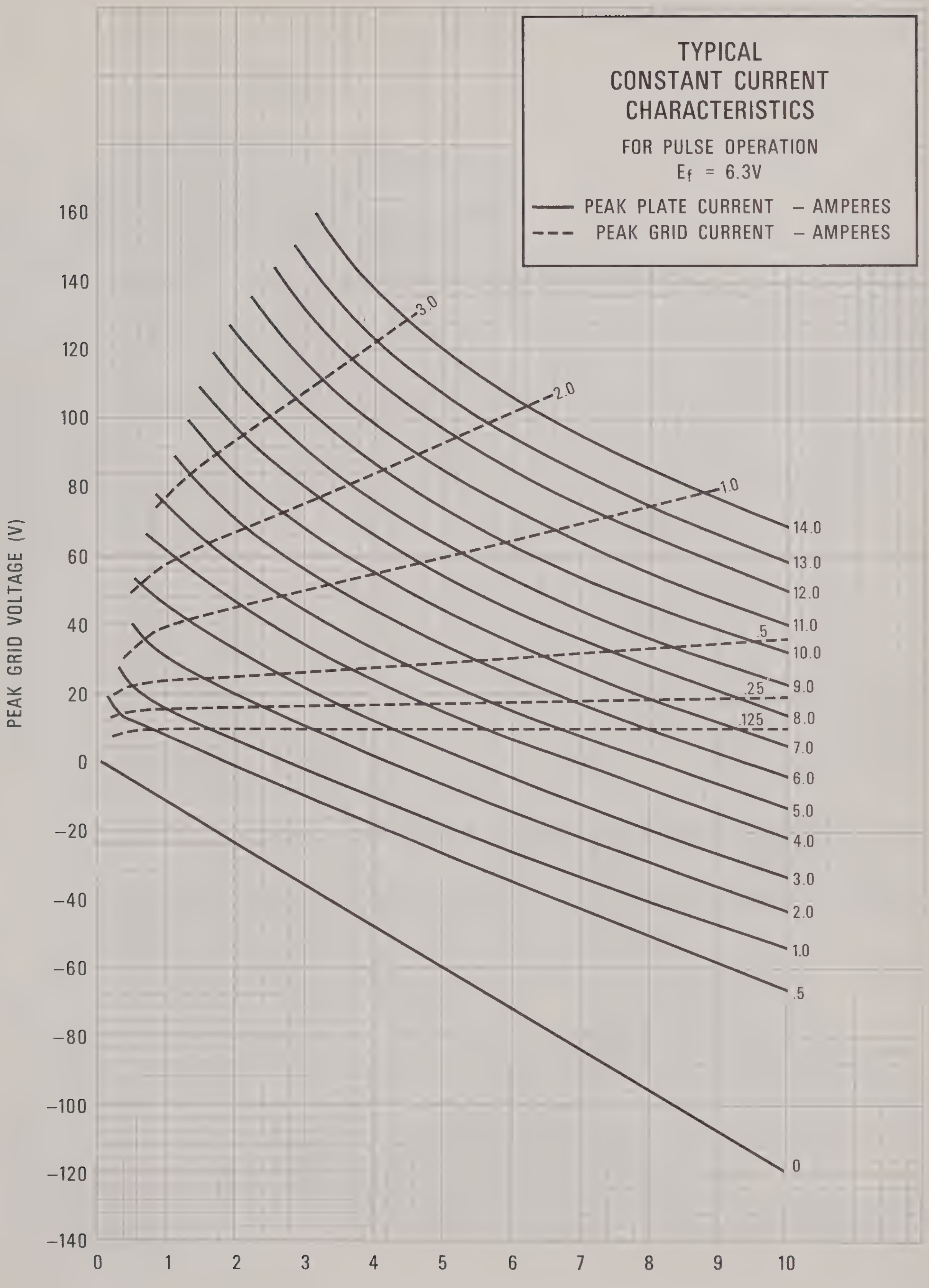
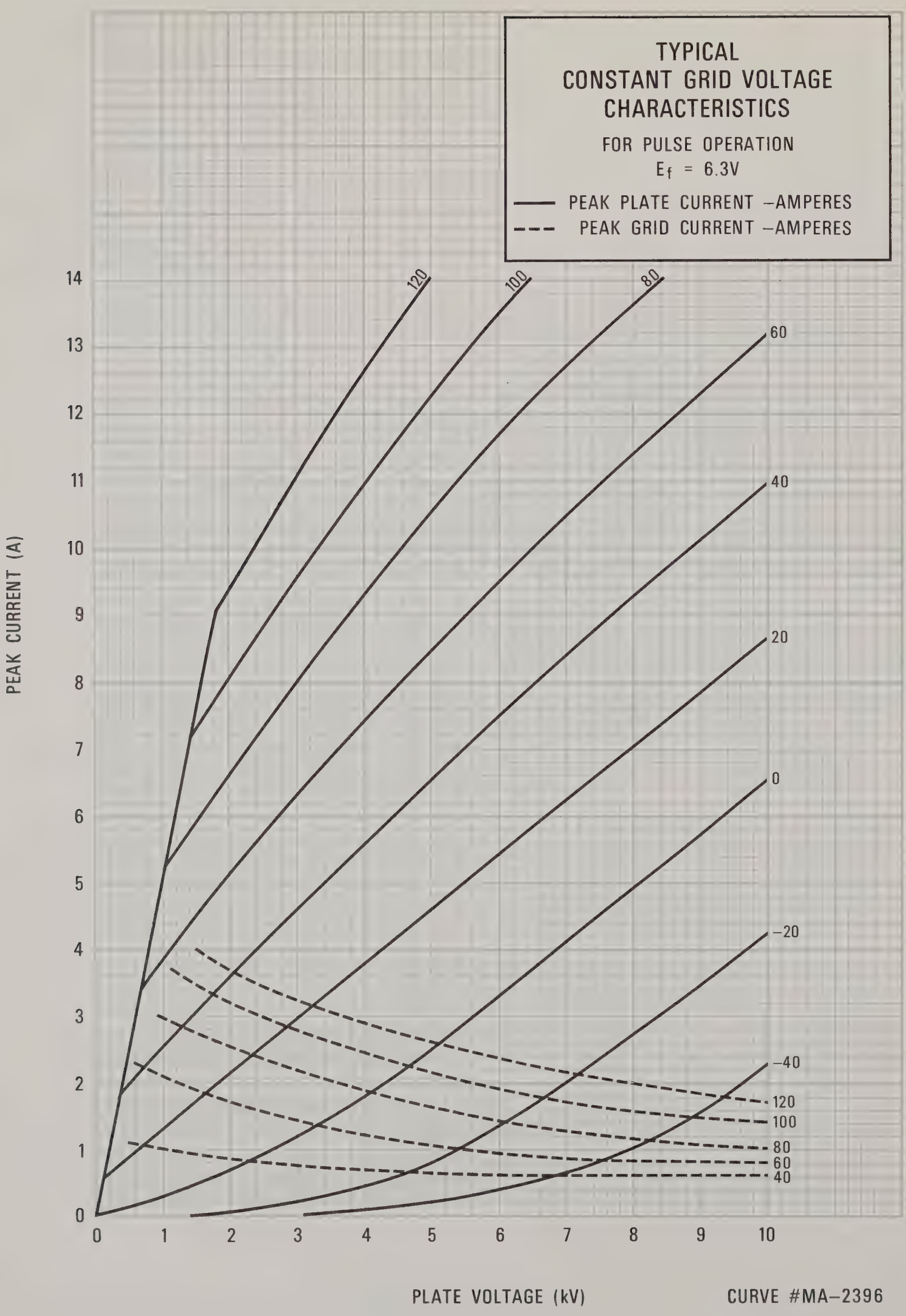


PLATE VOLTAGE (kV)

CURVE #MA–2395



CURVE #MA–2396

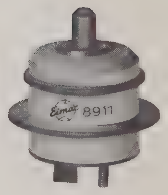
TECHNICAL DATA

PRELIMINARY DATA

8911

PLANAR TRIODE

The 8911 (formerly X2153) is a compact, rugged ceramic/metal planar triode intended for CW plate- or grid-pulsed oscillator, amplifier, or frequency multiplier use. It features high power output, high plate dissipation and excellent frequency stability under severe environmental conditions. The construction of the 8911 readily lends itself to cavity circuit operation resulting in an extremely compact rf source. The 8911 is capable of providing in excess of 1 kw peak power at 6 GHz.



Actual Size

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Cathode: Oxide Coated, Unipotential	
Heater: Voltage	6.3 ± 5% V
Current, at 6.3 volts	0.65 A
Cathode Heating Time	60 sec.
Transconductance (Average)	30 mmhos
Amplification Factor (Average)	60
Direct Interelectrode Capacitance, without heater voltage	
Grid-Cathode	5.00 pF
Grid-Plate	1.50 pF
Plate-Cathode (maximum)	0.06 pF
Plate Dissipation (maximum)[2]	50 W
Grid Dissipation (maximum)	1.5 W

MECHANICAL

Maximum Overall Dimensions:	
Length	0.943 in; 23.95 mm
Diameter	0.758 in; 19.25 mm
Net Weight	0.25 oz; 7.0 gm
Operating Position	Any
Maximum Operating Temperature:	
Ceramic/Metal Seals	250°C
Cooling	Conduction and Forced Air

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[1] The data presents the nominal design objectives for this product and the characteristics and specifications of this type are subject to change. The device is now under development and is made available for experimental purposes only. For the most recent information concerning the status of this development, please contact your nearest Varian Electron Tube and Device Field Office or the Product Manager, Eimac Division of Varian, Salt Lake City, Utah.

[2] With forced air cooling or appropriate conduction and/or convection cooling.

RF OSCILLATOR
Class C, Pulsed

ABSOLUTE MAXIMUM RATINGS:

DC PLATE VOLTAGE	2.0	kVdc
PEAK PLATE VOLTAGE	3.0	kv
DC PLATE CURRENT	100	mAdc
DC GRID CURRENT	30	mAdc
PEAK PLATE CURRENT	3.0	a
PEAK GRID CURRENT	1.2	a
DC GRID VOLTAGE	-100	Vdc
PULSE DURATION[1]	3.0	µs
DUTY FACTOR[1]	.0025	
PEAK HEATER-CATHODE VOLTAGE[2]	±50	v
FREQUENCY	6.0	GHz

[1] For applications requiring longer pulse duration and/or higher duty factor, please consult the Product Manager, EIMAC-Division of Varian, Salt Lake City, Utah.

[2] The heater is electrically isolated from the cathode.

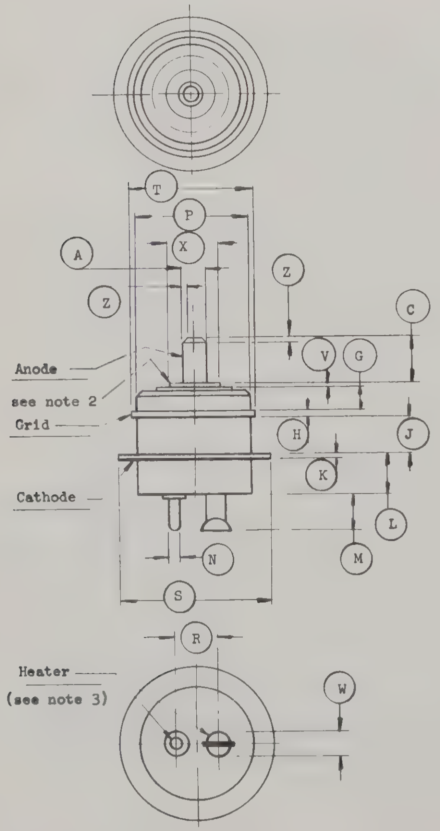
APPLICATION

The cathode and grid flanges should not be altered in any way such as by machining or filing, since final seal could be damaged. Maximum torque applied to flanges during installation should not exceed 15 inch pounds.

For optimum rf performance, the anode line should make good rf contact on the anode area indicated in the outline drawing.

Soldered connections may be made to the anode stud, grid or cathode flanges, and heater contacts where adequate heat sinking and good soldering practices are followed to minimize the heat applied to the tube and the thermal gradient across the metal to ceramic brazed areas.

For operating information refer to EIMAC bulletin #15, "Operating Instructions for Planar Triodes".



DIMENSIONAL DATA						
DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	0.122	0.128	- -	3.10	3.25	- -
B	0.200	0.210	- -	5.08	5.33	- -
C	0.120	0.130	- -	3.05	3.30	- -
H	0.025	0.031	- -	0.64	0.79	- -
J	0.167	0.177	- -	4.24	4.50	- -
K	0.025	0.031	- -	0.64	0.79	- -
L	0.170	0.185	- -	4.32	4.70	- -
M	0.170	0.190	- -	4.32	4.83	- -
N	0.047	0.053	- -	1.19	1.35	- -
P	0.535	0.565	- -	13.59	14.35	- -
R	0.185	0.215	- -	4.70	5.46	- -
S	0.748	0.758	- -	19.00	19.30	- -
T	0 598	0.608	- -	15.19	15.44	- -
V	- -	0.020	- -	- -	0.51	- -
W	- -	- -	0.100	- -	- -	2.54
X	0.250	0.260	- -	6.35	6.60	- -
Z	- -	- -	0.030	- -	- -	0.76

Notes:
1. Ref. dims. are for info. only & are not required for insp. purposes.
2. For optimum rf performance the Anode Line should contact the Anode Cup at this point.
3. Heater is electrically isolated from Cathode.

Eimac®

TECHNICAL DATA

PRELIMINARY DATA

8912

PLANAR TRIODE

The 8912 (formerly X2154) is a compact, rugged ceramic/metal planar triode intended for CW plate- or grid-pulsed oscillator, amplifier, or frequency multiplier use. It features high power output, high plate dissipation and excellent frequency stability under severe environmental conditions. The construction of the 8912 readily lends itself to cavity circuit operation resulting in an extremely compact rf source. The 8912 is capable of providing in excess of 1 kw peak power at 6 GHz.

Actual Size

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Cathode: Oxide Coated, Unipotential

Heater: Voltage	6.3 ± 5%	V
Current, at 6.3 volts	0.65	A
Cathode Heating Time	60	sec.
Transconductance (Average)	30	mmhos
Amplification Factor (Average)	85	

Direct Interelectrode Capacitance, without heater voltage

Grid-Cathode	5.00	pF
Grid-Plate	1.50	pF
Plate-Cathode (maximum)	0.06	pF
Plate Dissipation (maximum)[2]	50	W
Grid Dissipation (maximum)	1.5	W

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1. The data presents the nominal design objectives for this product and the characteristics and specifications of this type are subject to change. The device is now under development and is made available for experimental purposes only. For the most recent information concerning the status of this development, please contact your nearest Varian Electron Tube and Device Field Office or the Product Manager, Eimac Division of Varian, Salt Lake City, Utah.

2. With forced air cooling or appropriate conduction and/or convection cooling.

MECHANICAL

Maximum Overall Dimensions:

Length	1.013 in; 25.73 mm
Diameter	0.608 in; 15.44 mm
Net Weight	0.25 oz; 7.0 gm
Operating Position	Any

Maximum Operating Temperature:

Ceramic/Metal Seals	250°C
Cooling	Conduction and Forced Air

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RF OSCILLATOR
Class C, Pulsed

ABSOLUTE MAXIMUM RATINGS:

DC PLATE VOLTAGE	2.0 kVdc
PEAK PLATE VOLTAGE	2.5 kv
DC PLATE CURRENT	100 mAdc
DC GRID CURRENT	30 mAdc
PEAK PLATE CURRENT	3.0 a at .0025 DUTY 1.5 a at .01 DUTY
PEAK GRID CURRENT	1.2 a at .0025 DUTY 0.7 a at .01 DUTY
DC GRID VOLTAGE	-100 Vdc
PULSE DURATION[1]	3.0 µs
DUTY FACTOR[1]	.01
PEAK HEATER-CATHODE VOLTAGE[2]	±50 v
FREQUENCY	6.0 GHz

1. For applications requiring longer pulse duration and/or higher duty factor, please consult the Product Manager, EIMAC-Division of Varian, Salt Lake City, Utah.

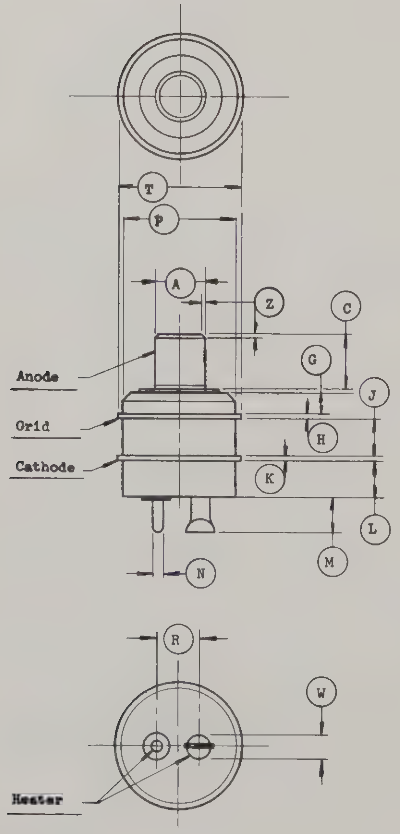
2. The heater is electrically isolated from the cathode.

APPLICATION

The cathode and grid flanges should not be altered in any way such as by machining or filing, since final seal could be damaged. Maximum torque applied to flanges during installation should not exceed 15 inch pounds.

For optimum rf performance, the anode line should make good rf contact on the anode area indicated in the outline drawing.

Soldered connections may be made to the anode stud, grid or cathode flanges, and heater contacts where adequate heat sinking and good soldering practices are followed to minimize the heat applied to the tube and the thermal gradient across the metal to ceramic brazed areas. For operating information refer to EIMAC bulletin #15, "Operating Instructions for Planar Triodes".



DIMENSIONAL DATA						
DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	0.245	0.260	- -	6.22	6.60	- -
C	0.240	0.255	- -	6.10	6.48	- -
G	0.120	0.155	- -	3.05	3.93	- -
H	0.025	0.031	- -	0.64	0.79	- -
J	0.167	0.177	- -	4.24	4.50	- -
K	0.025	0.031	- -	0.64	0.79	- -
L	0.170	0.185	- -	4.32	4.70	- -
M	0.170	0.190	- -	4.32	4.83	- -
N	0.047	0.053	- -	1.19	1.35	- -
P	0.535	0.565	- -	13.59	14.35	- -
R	0.185	0.215	- -	4.70	5.46	- -
T	0.598	0.608	- -	15.19	15.44	- -
W	- -	- -	0.100	- -	- -	2.54

Note;
1. Ref. Dims. are for info. only and are not req'd. for inspection purposes.

EITEL-McCULLOUGH, INC.
SAN CARLOS, CALIFORNIA

25T

MEDIUM-MU TRIODE

•

MODULATOR
OSCILLATOR
AMPLIFIER

▶ The Eimac 25T is a medium-mu, power triode having a maximum plate dissipation of 25 watts and is intended for use as an amplifier, oscillator or modulator. It can be used at its maximum ratings at frequencies as high as 60 Mc.

Cooling of the 25T is accomplished by radiation from the plate, which operates at a visible red color at maximum dissipation and by means of air convection around the envelope.

GENERAL CHARACTERISTICS

▶ ELECTRICAL

Filament: Thoriated tungsten	
Voltage	6.3 volts
Current	3.0 amperes
Amplification Factor (Average)	24
Direct Interelectrode Capacitances (Average)	
Grid-Plate	1.5 $\mu\mu$f
Grid-Filament	2.2 $\mu\mu$f
Plate-Filament	0.2 $\mu\mu$f
Transconductance ($i_b = 25$ ma., $E_b = 1000$ v.)	2500 μmhos
Frequency for Maximum Ratings	60 Mc.

▶ MECHANICAL

Base	Small 4-pin, RMA type A4-5
Basing (See outline drawing)	RMA type 3G
Mounting	Vertical, base down or up
Cooling	Convection and Radiation
Recommended Heat Dissipating Connector:	
Plate	HR-1
Maximum Overall Dimensions:	
Length	4.38 inches
Diameter	1.44 inches
Net Weight	1.5 ounces
Shipping Weight (Average)	1.0 pound

▶ AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class-B

MAXIMUM RATINGS, PER TUBE

D-C PLATE VOLTAGE	2000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT	75 MAX. MA.
PLATE DISSIPATION	25 MAX. WATTS
GRID DISSIPATION	7 MAX. WATTS

TYPICAL OPERATION, CLASS AB_2
Sinusoidal wave, two tubes unless otherwise specified

D-C Plate Voltage	750	1000	1250	Volts
D-C Grid Voltage (approx.)*	—20	—30	—42	Volts
Zero-Signal D-C Plate Current	43	32	24	Ma.
Max-Signal D-C Plate Current	127	127	130	Ma.
Effective Load, Plate-to-Plate	12,000	17,000	21,400	Ohms
Peak A-F Grid Input Voltage (per tube)	110	120	135	Volts
Max-Signal Peak Driving Power	5.5	6.0	6.8	Watts
Max-Signal Nominal Driving Power (approx.)	2.8	3.0	3.4	Watts
Max-Signal Plate Power Output	60	85	112	Watts

*Adjust to give stated zero-signal plate current.

▶ PLATE MODULATED RADIO FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	1600 MAX. VOLTS
D-C PLATE CURRENT	60 MAX. MA.
PLATE DISSIPATION	17 MAX. WATTS
GRID DISSIPATION	7 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	1000	1250	1600	Volts
D-C Plate Current	60	60	53	Ma.
D-C Grid Voltage	—120	—140	—170	Volts
D-C Grid Current	14	13	11	Ma.
Peak R-F Grid Input Voltage	235	255	280	Volts
Driving Power	3.3	3.3	3.1	Watts
Grid Dissipation	1.6	1.5	1.2	Watts
Plate Power Input	60	75	85	Watts
Plate Dissipation	13	15	17	Watts
Plate Power Output	47	60	68	Watts

The above figures show actual measured tube performance and do not allow for variations in circuit losses.

▶ RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony (Key-down conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	2000 MAX. VOLTS
D-C PLATE CURRENT	75 MAX. MA.
PLATE DISSIPATION	25 MAX. WATTS
GRID DISSIPATION	7 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	1000	1500	2000	Volts
D-C Plate Current	72	67	63	Ma.
D-C Grid Voltage	—70	—95	—130	Volts
D-C Grid Current	9	13	18	Ma.
Peak R-F Grid Input Voltage	170	195	245	Volts
Driving Power	1.3	2.2	4.0	Watts
Grid Dissipation	.9	1.3	2.1	Watts
Plate Power Input	72	100	125	Watts
Plate Dissipation	25	25	25	Watts
Plate Power Output	47	75	100	Watts

The above figures show actual measured tube performance and do not allow for variations in circuit losses.

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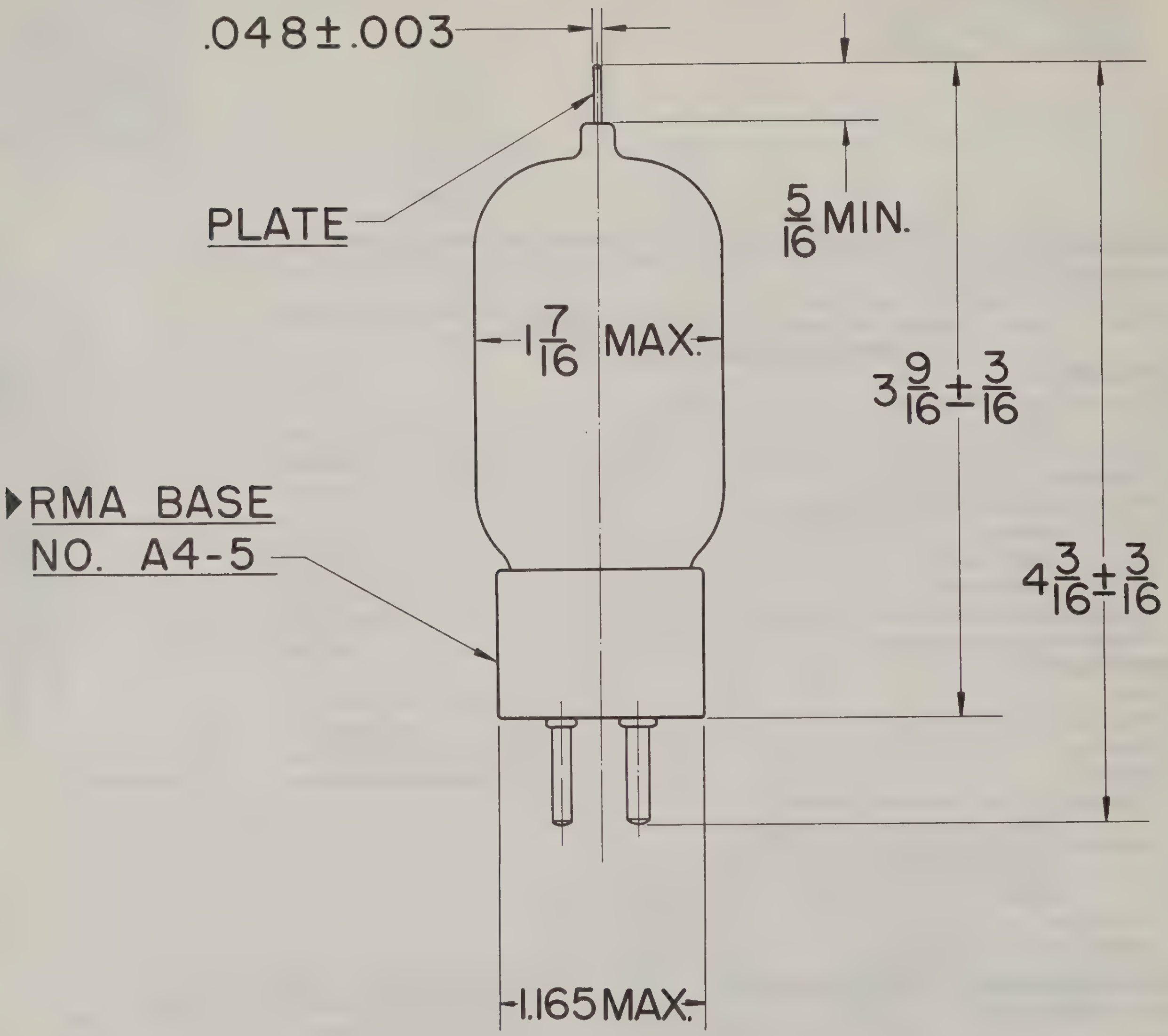
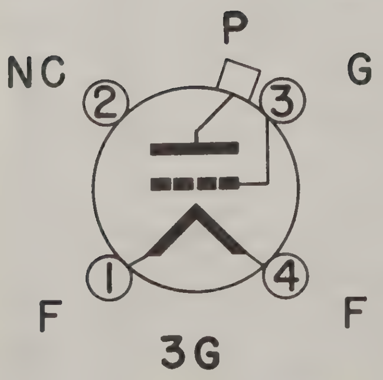
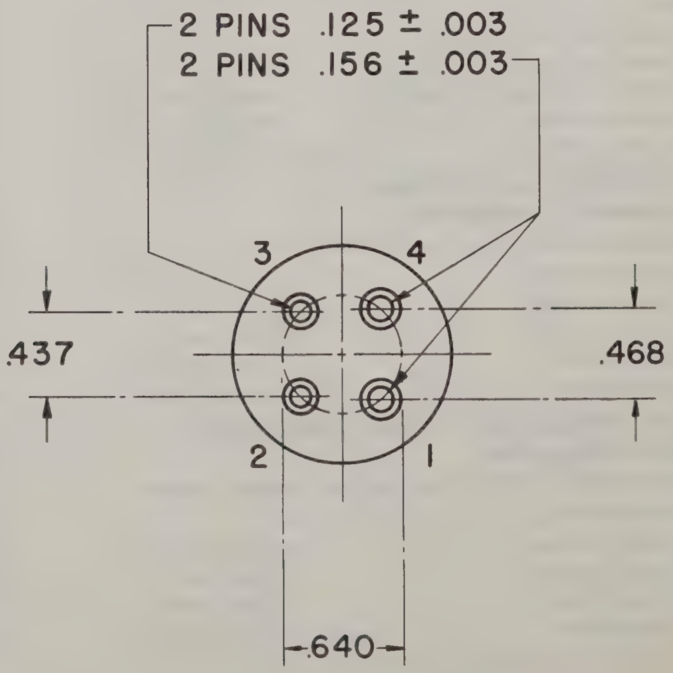
▶ Indicates change from sheet dated 10-15-44.


.048±.003
PLATE
5/16 MIN.
1 7/16 MAX.
3 9/16 ± 3/16
▸RMA BASE
NO. A4-5
4 3/16 ± 3/16
1.165 MAX.

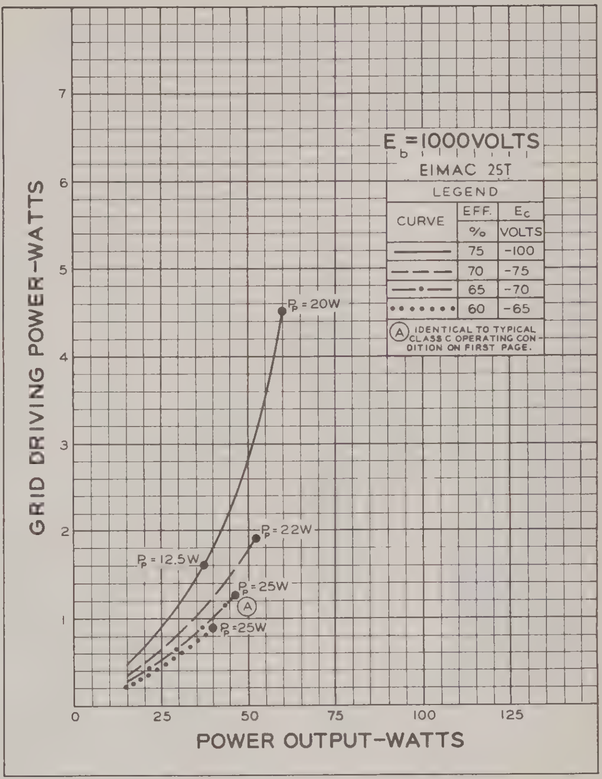

P
NC
G
②
③
①
④
F
F
3G

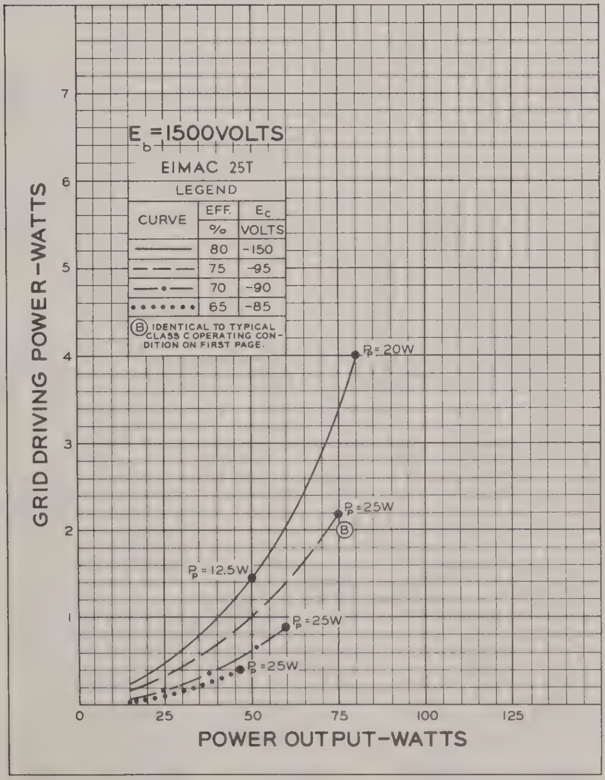

2 PINS .125 ± .003
2 PINS .156 ± .003
3
4
2
1
.437
.468
.640

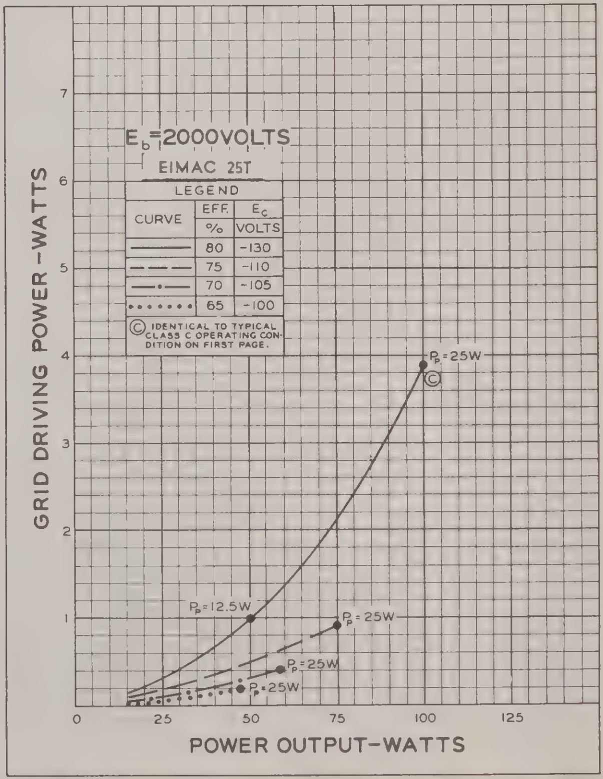
DRIVING POWER vs. POWER OUTPUT

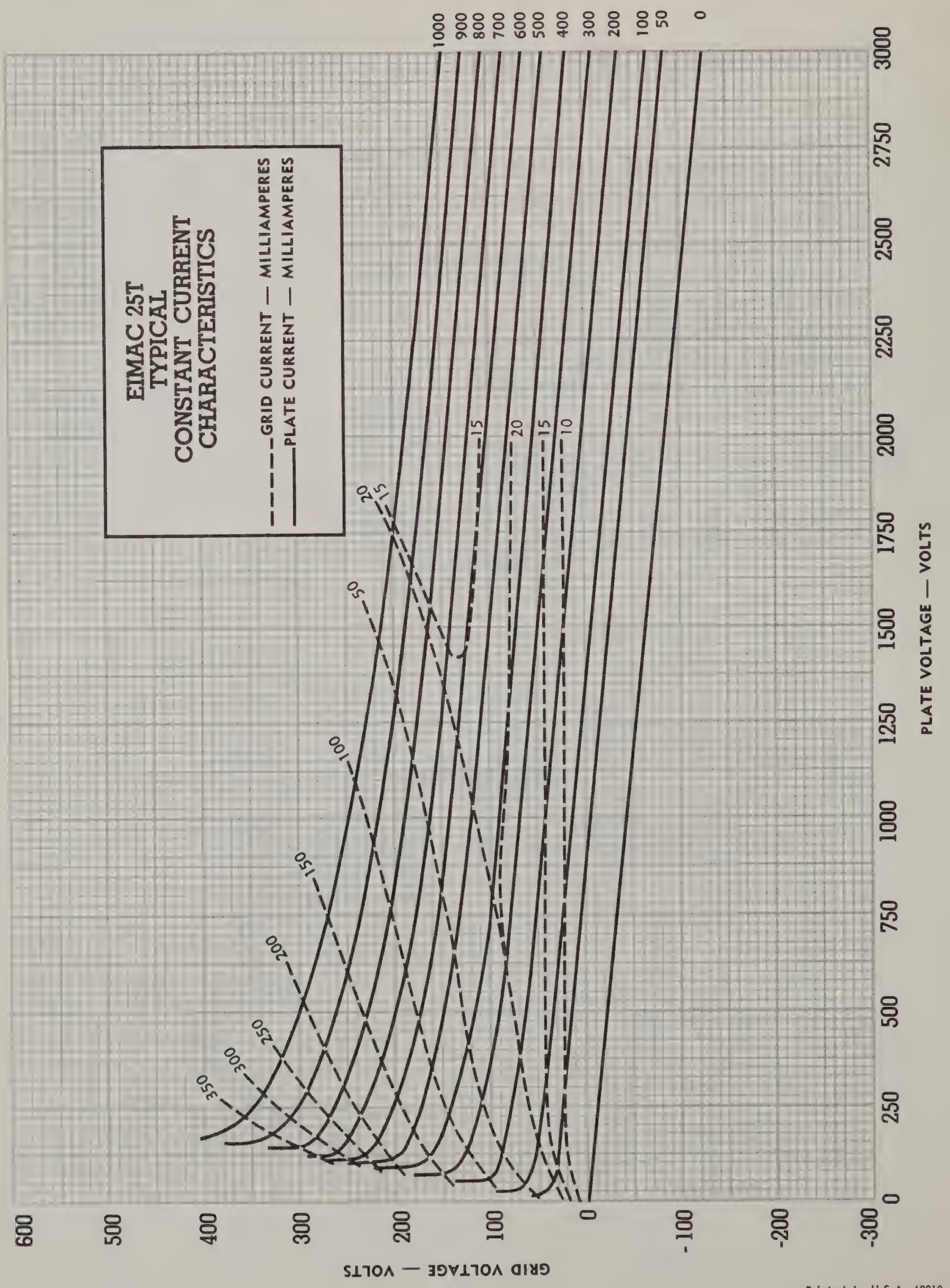
The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 1000, 1500 and 2000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 1000, 1500, and 2000 volts respectively.









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Eimac®

EITEL-McCULLOUGH, INC.

35T

HIGH-MU TRIODE

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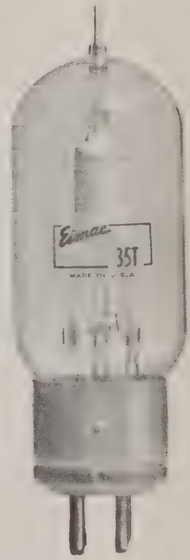
MODULATOR

OSCILLATOR

AMPLIFIER



The Eimac 35T is a high-mu triode having a maximum plate dissipation of 50 watts. It is intended for use as an amplifier, oscillator or modulator, and can be used at its maximum ratings at frequencies up to 100 Mc.

The 35T is cooled by radiation and by free circulation of air around the envelope. The plate operates at a visible red color at full dissipation.

GENERAL CHARACTERISTICS

▶ ELECTRICAL

Filament: Thoriated Tungsten	Min.	Nom.	Max.	
Voltage		5.0		volts
Current	3.6		4.2	amperes
Amplification Factor	35		43	
Direct Interelectrode Capacitances:				
Grid-Plate	1.4		2.2	uuf
Grid-Filament	3.0		5.0	uuf
Plate-Filament	0.08		0.23	uuf
Transconductance (I_b=100 ma.)		2850		umhos
Frequency for Maximum Ratings			100	mc

MECHANICAL

Base: UX Medium 4-pin. Fits E. F. Johnson Co. 122-224, or National XC-4 or CIR-4 sockets.

Basing	See outline drawing
Mounting	Vertical, base down or up.
Cooling	Convection and radiation.
Recommended Heat-Dissipating Plate Connector	Eimac HR-3
Maximum Overall Dimensions:	
Length	5.5 inches
Diameter	1.8 inches
Net weight	2.5 ounces
Shipping weight (Average)	1.25 pounds

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class-AB₂ (Sinusoidal wave, two tubes unless otherwise specified)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	2000 MAX. VOLTS
D-C PLATE CURRENT	150 MAX. MA.
PLATE DISSIPATION	50 MAX. WATTS
GRID DISSIPATION	15 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	600	1000	1500	2000	Volts
D-C Grid Voltage (approx.)*	0	—8	—25	—40	Volts
Zero-signal D-C Plate Current	90	67	45	34	Ma.
Max-signal D-C Plate Current	300	240	200	167	Ma.
Effective Load Plate-to-Plate	4250	7900	16,200	27,500	Ohms
Peak A-F Input Voltage (per tube)	130	240	250	255	Volts
Peak Driving Power (approx.)	18	14	10	8	Watts
Nominal Driving Power (approx.)	9	7	5	4	Watts
Max-signal Plate Power Output	95	140	200	235	Watts

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony
(Key-down conditions, per tube)[1]

MAXIMUM RATINGS

D-C PLATE VOLTAGE	2000 MAX. VOLTS
D-C PLATE CURRENT	150 MAX. MA.
PLATE DISSIPATION	50 MAX. WATTS
GRID DISSIPATION	15 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	1000	1500	2000	Volts
D-C Grid Voltage	—60	—120	—135	Volts
D-C Plate Current	125	125	125	Ma.
D-C Grid Current	40	40	45	Ma.
Peak R-F Grid Input Voltage	165	250	285	Volts
Driving Power (approx.)	7	9	13	Watts
Grid Dissipation	4.2	5.0	6.8	Watts
Plate Power Input	125	188	250	Watts
Plate Dissipation	38	47	50	Watts
Plate Power Output	87	141	200	Watts

PLATE MODULATED RADIO FREQUENCY POWER AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)[1]

MAXIMUM RATINGS

D-C PLATE VOLTAGE	1600 MAX. VOLTS
D-C PLATE CURRENT	120 MAX. MA.
PLATE DISSIPATION	33 MAX. WATTS
GRID DISSIPATION	15 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	750	1000	1500	Volts
D-C Grid Voltage	—100	—125	—150	Volts
D-C Plate Current	95	100	90	Ma.
D-C Grid Current	40	40	40	Ma.
Peak R-F Driving Voltage (approx.)	210	240	270	Volts
Driving Power (approx.)	9	10	11	Watts
Plate Dissipation	20	25	30	Watts
Plate Input	70	100	135	Watts
Plate Power Output	50	75	105	Watts

*Adjust for stated zero-signal plate current.

---

[1] The performance figures listed under Typical Operation are for radio frequencies up to the VHF region and are obtained by calculation from the characteristic tube curves and confirmed by direct tests. The driving power given includes power taken by the tube grid and the bias circuit. The driving power and output power do not allow for losses in the associated resonant circuits. These losses are not included because they depend principally upon the design and choice of the circuit components.

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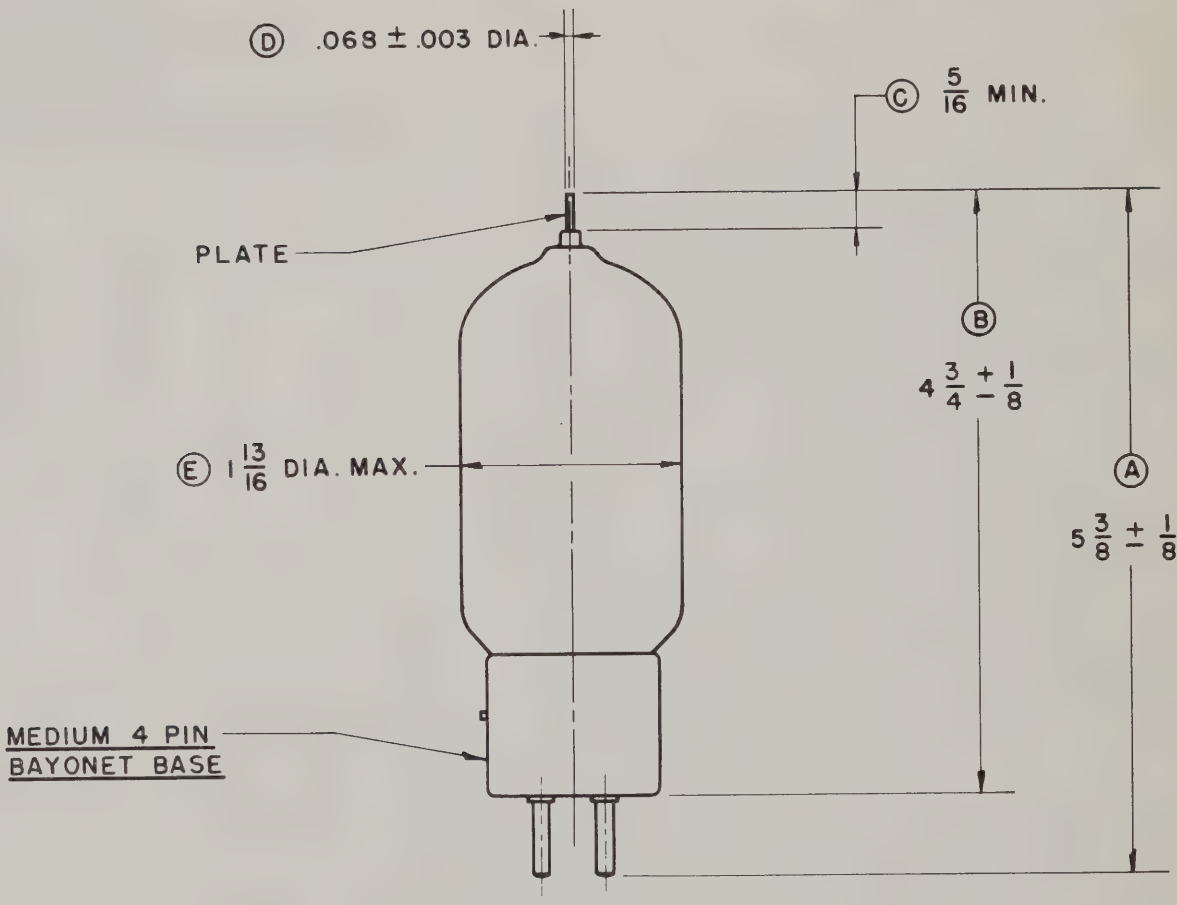
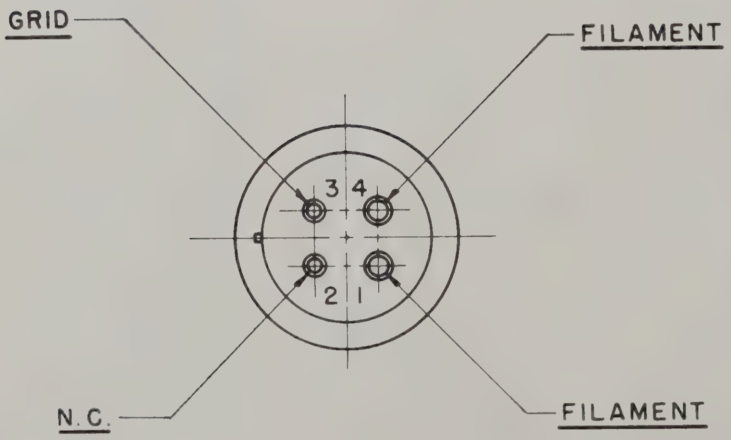
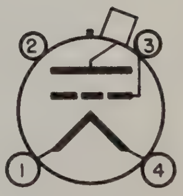
▶ Indicates change from sheet dated 6-15-51.







DESIGN TEST MEASUREMENTS: A, E,

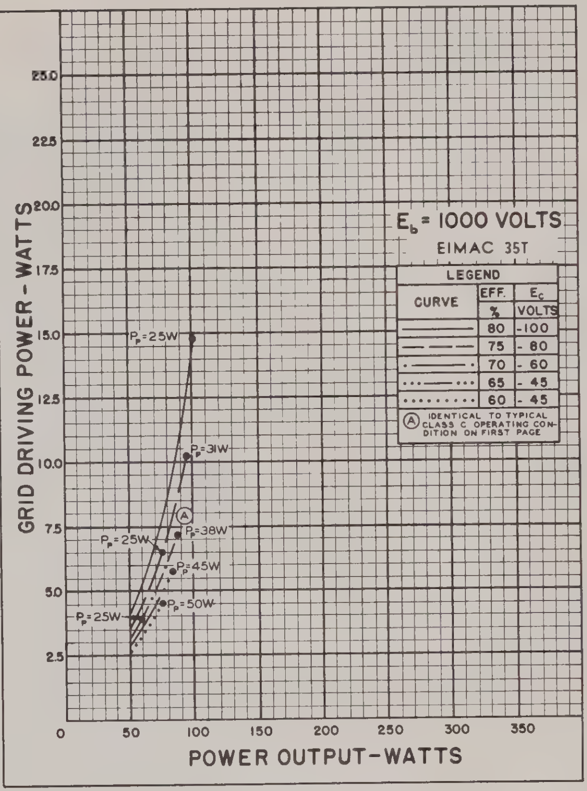
TYPE APPROVAL MEASUREMENTS: B, D,

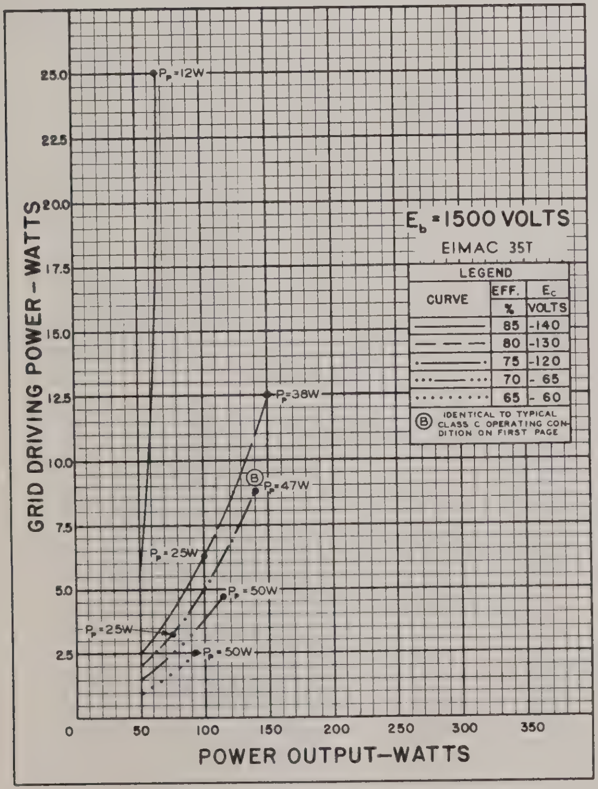
PRODUCTION TEST MEASUREMENTS: C,

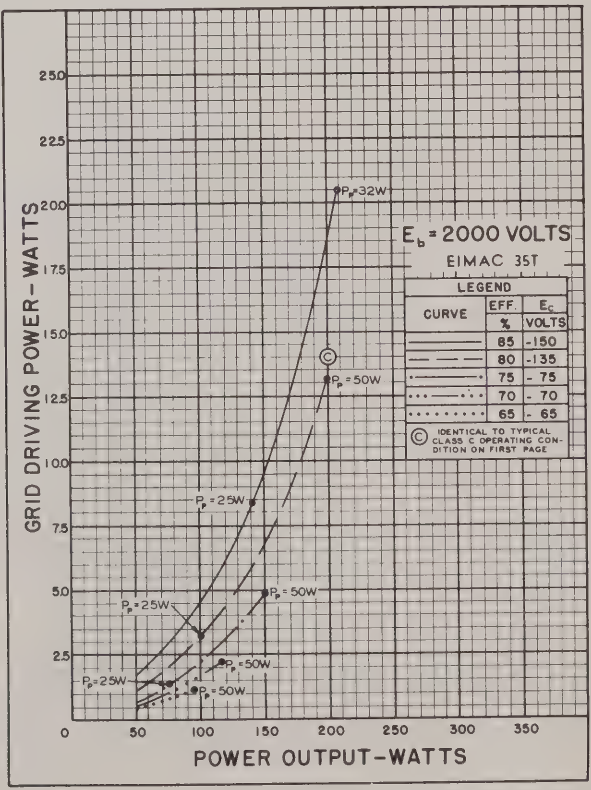
DRIVING POWER vs. POWER OUTPUT

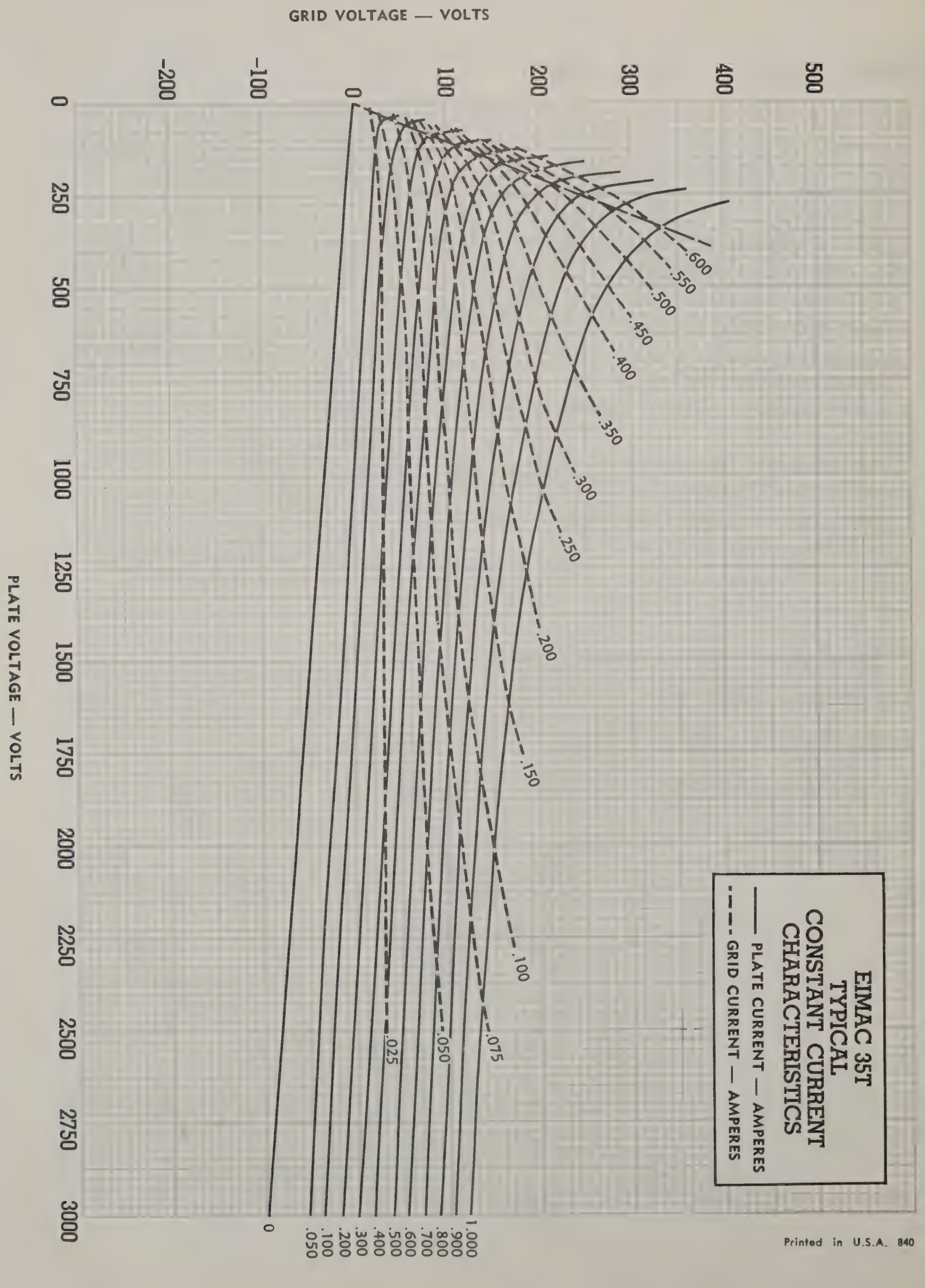
The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 1000, 1500 and 2000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 1000, 1500, and 2000 volts respectively.








EIMAC 35T TYPICAL CONSTANT CURRENT CHARACTERISTICS

Printed in U.S.A. 840

Eimac®

EITEL-McCULLOUGH, INC.
SAN CARLOS, CALIFORNIA

35TG

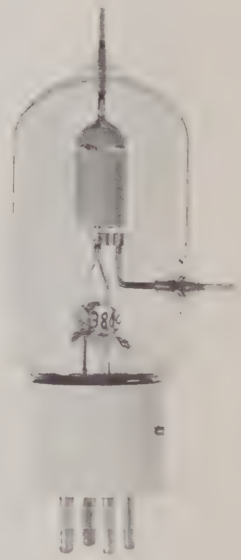
HIGH-MU TRIODE

●

MODULATOR
OSCILLATOR
AMPLIFIER

The Eimac 35TG is a high-mu triode having a maximum plate dissipation of 50 watts. It is intended for use as an amplifier, oscillator or modulator, and can be used at its maximum ratings at frequencies up to 100 Mc. It is basically the same as the Eimac 35T except that the grid terminal is located at the side of the bulb.

The 35TG is cooled by radiation and by free circulation of air around the envelope.



GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten	Min.	Nom.	Max.	
Voltage	-	5.0		volts
Current	3.6		4.2	amperes
Amplification Factor	35		43	
Direct Interelectrode Capacitances:				
Grid-Plate	1.25		2.05	uuf
Grid-Filament	2.00		3.20	uuf
Plate-Filament	0.10		0.35	uuf
Transconductance (I_b=100 ma.)		2850		umhos
Frequency for Maximum Ratings			100	mc

MECHANICAL

Base: UX Medium 4-pin. Fits E. F. Johnson Co. 122-224, or National XC-4 or CIR-4 sockets.

Basing	See outline drawing
Mounting	Vertical, base down or up.
Cooling	Convection and radiation.
Recommended Heat Dissipating Plate Connector	Eimac HR-3
Maximum Overall Dimensions:	
Length	5.5 inches
Diameter	1.8 inches
Net weight	2.5 ounces
Shipping weight (Average)	1.25 pounds

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class-AB₂ (Sinusoidal wave, two tubes unless otherwise specified)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	2000 MAX. VOLTS
D-C PLATE CURRENT	150 MAX. MA.
PLATE DISSIPATION	50 MAX. WATTS
GRID DISSIPATION	15 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	600	1000	1500	2000	volts
D-C Grid Voltage (approx.)*	0	—8	—25	—40	volts
Zero-signal D-C Plate Current	90	67	45	34	ma
Max-signal D-C Plate Current	300	240	200	167	ma
Effective Load Plate-to-Plate	4250	7900	16,200	27,500	ohms
Peak A-F Input Voltage (per tube)	130	240	250	255	volts
Peak Driving Power (approx.)	18	14	10	8	watts
Nominal Driving Power (approx.)	9	7	5	4	watts
Max-signal Plate Power Output	95	140	200	235	watts

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony
(Key-down conditions, per tube)[1]

MAXIMUM RATINGS

D-C PLATE VOLTAGE	2000 MAX. VOLTS
D-C PLATE CURRENT	150 MAX. MA.
PLATE DISSIPATION	50 MAX. WATTS
GRID DISSIPATION	15 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	1000	1500	2000	volts
D-C Grid Voltage	—60	—120	—135	volts
D-C Plate Current	125	125	125	ma
D-C Grid Current	40	40	45	ma
Peak R-F Grid Input Voltage	165	250	285	volts
Driving Power (approx.)	7	9	13	watts
Grid Dissipation	4.2	5.0	6.8	watts
Plate Power Input	125	188	250	watts
Plate Dissipation	38	47	50	watts
Plate Power Output	87	141	200	watts

PLATE MODULATED RADIO FREQUENCY POWER AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)[1]

MAXIMUM RATINGS

D-C PLATE VOLTAGE	1600 MAX. VOLTS
D-C PLATE CURRENT	120 MAX. MA.
PLATE DISSIPATION	33 MAX. WATTS
GRID DISSIPATION	15 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	750	1000	1500	volts
D-C Grid Voltage	—100	—125	—150	volts
D-C Plate Current	95	100	90	ma
D-C Grid Current	40	40	40	ma
Peak R-F Driving Voltage (approx.)	210	240	270	volts
Driving Power (approx.)	9	10	11	watts
Plate Dissipation	20	25	30	watts
Plate Input	70	100	135	watts
Plate Power Output	50	75	105	watts

*Adjust for stated zero-signal plate current.

[1] The performance figures listed under Typical Operation are for radio frequencies up to the VHF region and are obtained by calculation from the characteristic tube curves and confirmed by direct tests. The driving power given includes power taken by the tube grid and the bias circuit. The driving power and output power do not allow for losses in the associated resonant circuits. These losses are not included because they depend principally upon the design and choice of the circuit components.

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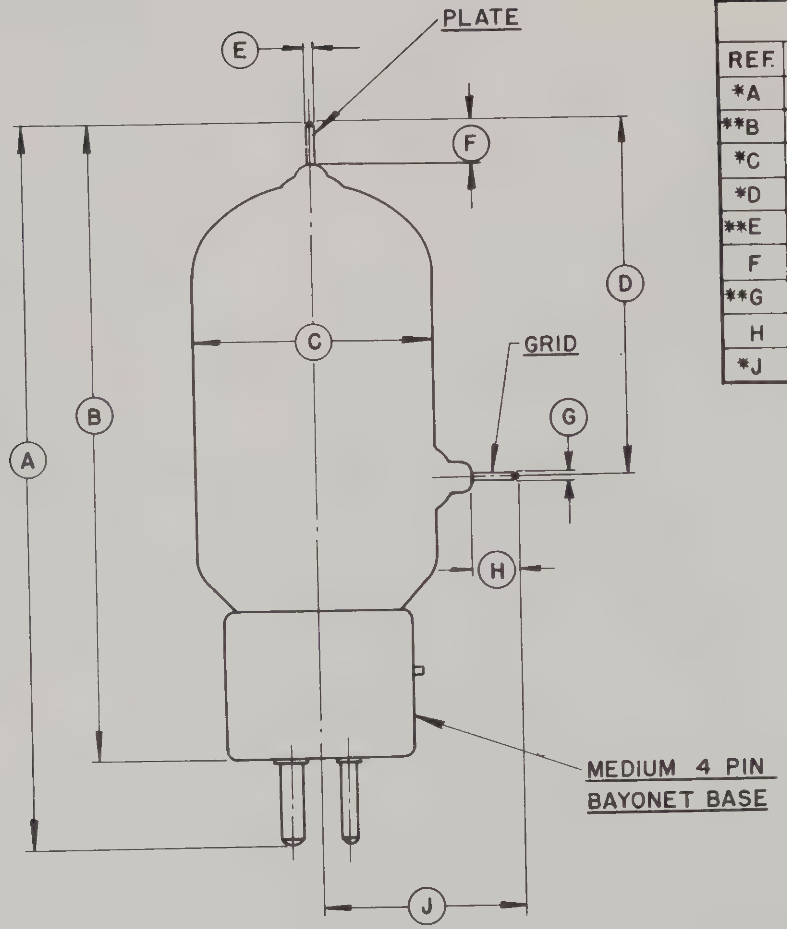
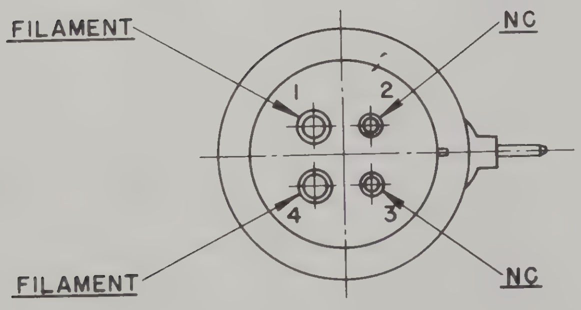
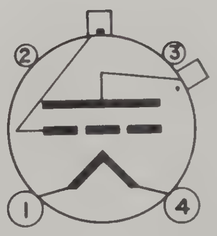


DIMENSION DATA			
REF.	NOM.	MIN.	MAX.
*A		5 3/8	5 3/4
**B		4 3/4	5 1/8
*C			1.813
*D		2.060	2.680
**E		.065	.071
F		.312	
**G		.065	.071
H		.312	
*J		1.370	1.630





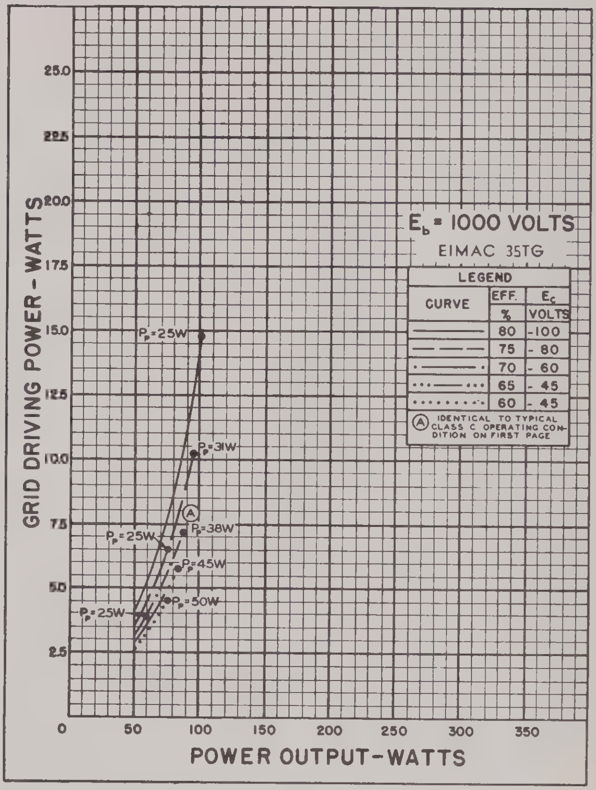
NOTES:

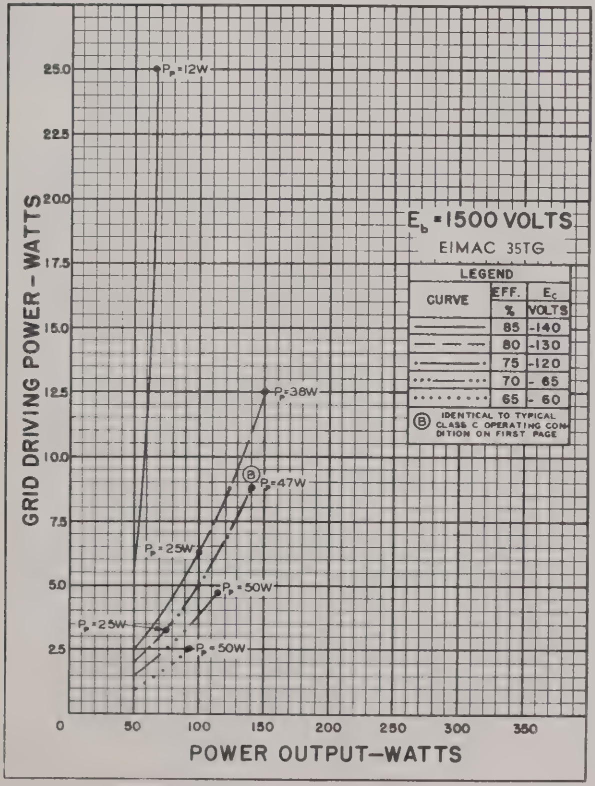
1. DIMENSIONS IN INCHES.
2. *STANDARD DESIGN TESTS & QUALIFICATION TESTS.
3. **QUALIFICATION TESTS.

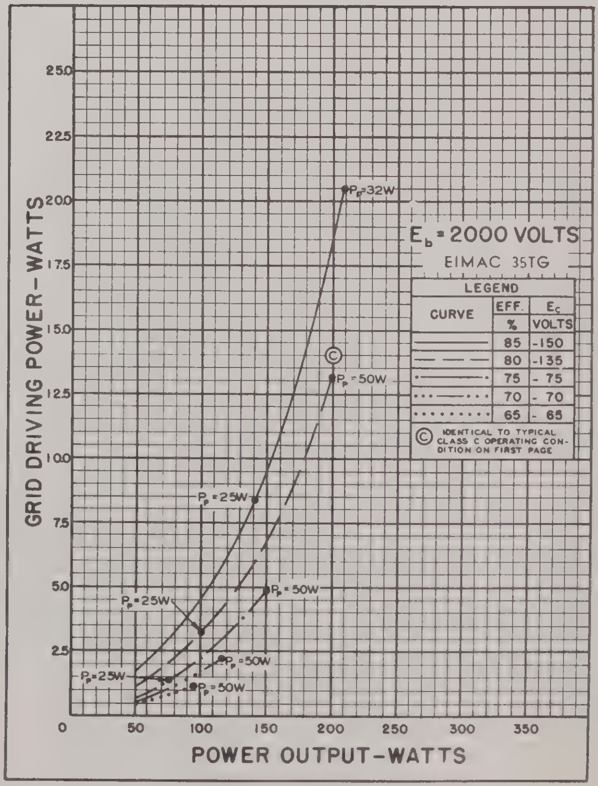
DRIVING POWER vs. POWER OUTPUT

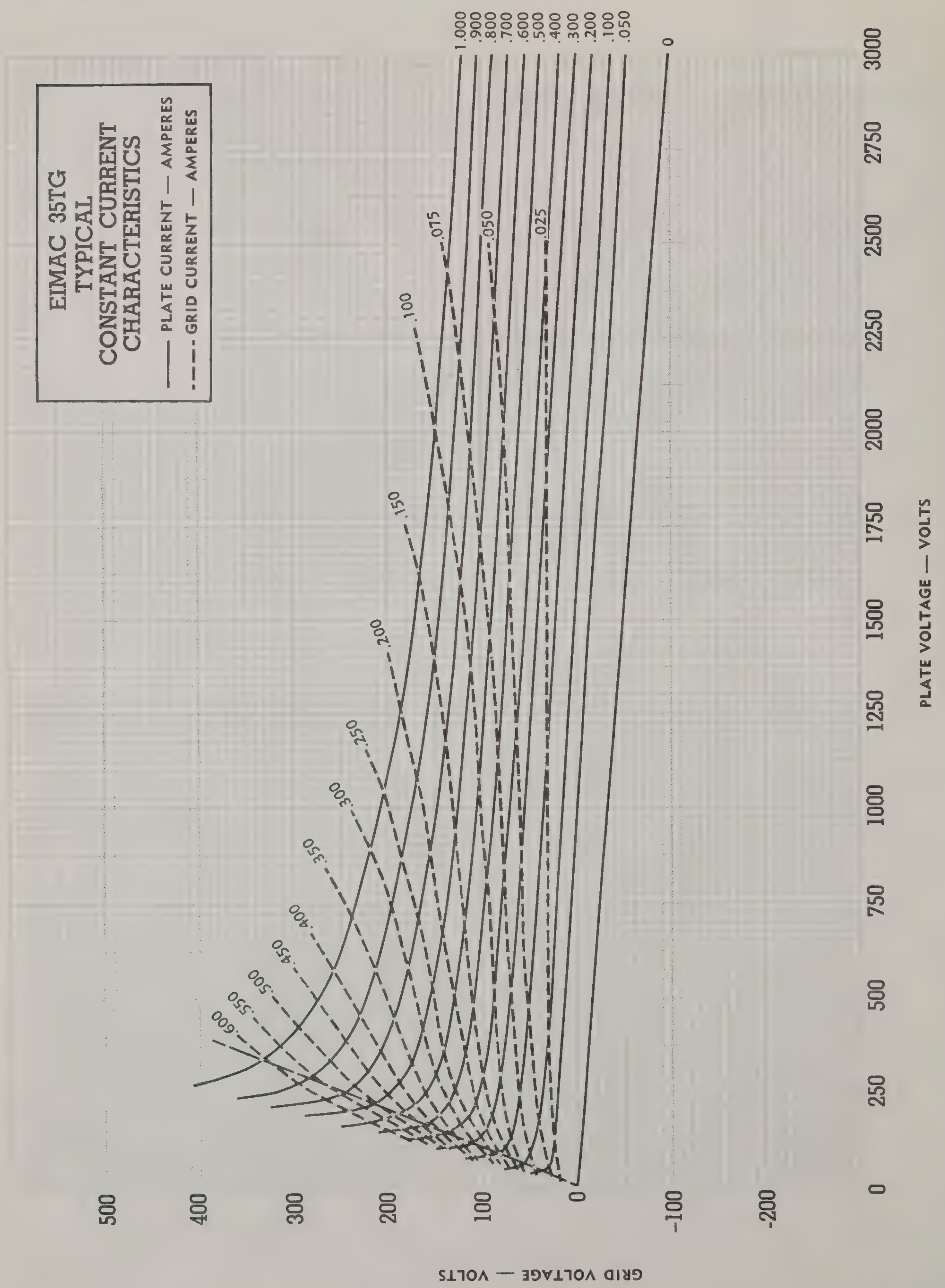
The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 1000, 1500 and 2000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 1000, 1500, and 2000 volts respectively.








EIMAC 35TG
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
—— PLATE CURRENT — AMPERES
- - - GRID CURRENT — AMPERES
1.000
.900
.800
.700
.600
.500
.400
.300
.200
.100
.050
0
.600
.550
.500
.450
.400
.350
.300
.250
.200
.150
.100
.075
.050
.025
GRID VOLTAGE — VOLTS
500
400
300
200
100
0
-100
-200
PLATE VOLTAGE — VOLTS
0
250
500
750
1000
1250
1500
1750
2000
2250
2500
2750
3000

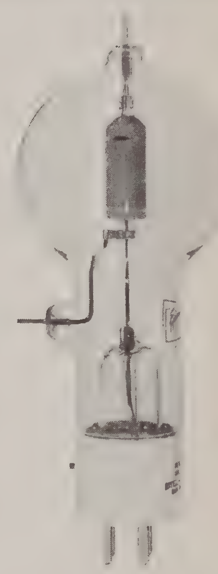
Eimac®

EITEL-McCULLOUGH, INC.
[illegible]

75TH

MEDIUM-MU TRIODE

MODULATOR
OSCILLATOR
AMPLIFIER



The Eimac 75TH is a medium-mu power triode intended for use as an amplifier, oscillator, or modulator. It has a maximum plate dissipation rating of 75 watts and a maximum plate voltage rating of 3000 volts at frequencies up to 40 Mc. Forced-air cooling is not required in properly designed equipment operating at frequencies below 40 Mc.

The 75TH in Class-C R-F service will deliver up to 225 watts plate power output with 10 watts driving power. Two 75TH's in Class-B modulator service will deliver up to 300 watts maximum-signal plate power output with 3 watts driving power.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten	
Voltage	5.0 volts
Current	6.25 amperes
Amplification Factor (Average)	20
Direct Interelectrode Capacitances (Average)	
Grid-Plate	2.3 μμf
Grid-Filament	2.7 μμf
Plate-Filament	0.3 μμf
Transconductance (I_b=225 ma., E_b=3000 v.)	4150 μmhos
Highest Frequency for Maximum Ratings	40 Mc

MECHANICAL

Base	Medium 4-pin bayonet
Basing	See outline drawing
Socket	Johnson type No. 122-224, National type No. XC-4 or CIR-4, or equivalent
Mounting Position	Vertical, base down or up
Cooling	Convection and radiation
Maximum Temperature of Plate and Grid Seals	225°C
Recommended Heat Dissipating Connectors:	
Plate	Eimac HR-3
Grid	Eimac HR-2
Maximum Overall Dimensions:	
Length	7.25 inches
Diameter	2.81 inches
Net Weight	3 ounces
Shipping Weight (Average)	1.5 pounds

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy (Key-down conditions, 1 tube)

MAXIMUM RATINGS (Frequencies up to 40 Mc.)

D-C PLATE VOLTAGE	3000 MAX. VOLTS
D-C PLATE CURRENT	225 MAX. MA.
PLATE DISSIPATION	75 MAX. WATTS
GRID DISSIPATION	16 MAX. WATTS

TYPICAL OPERATION (Frequencies up to 40 Mc.)

D-C Plate Voltage	1000	1500	2000	volts
D-C Grid Voltage	—80	—125	—200	volts
D-C Plate Current	215	167	150	ma.
D-C Grid Current (approx.)	35	23	32	ma.
Peak R-F Grid Input Voltage (approx.)	270	280	350	volts
Driving Power (approx.)	9	6	10	watts
Plate Power Input	215	250	300	watts
Plate Dissipation	75	75	75	watts
Plate Power Output	140	175	225	watts

PLATE MODULATED RADIO FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS (Frequencies up to 40 Mc.)

D-C PLATE VOLTAGE	2400 MAX. VOLTS
D-C PLATE CURRENT	180 MAX. MA.
PLATE DISSIPATION	50 MAX. WATTS
GRID DISSIPATION	16 MAX. WATTS

TYPICAL OPERATION (Frequencies up to 40 Mc.)

D-C Plate Voltage	1000	1500	2000	volts
D-C Grid Voltage	—150	—200	—300	volts
D-C Plate Current	135	115	110	ma.
D-C Grid Current (approx.)	20	14	15	ma.
Peak R-F Grid Input Voltage (approx.)	300	330	440	volts
Driving Power (approx.)	6	5	6	watts
Grid Dissipation	3	2	2	watts
Plate Power Input	135	175	220	watts
Plate Dissipation	50	50	50	watts
Plate Power Output	85	125	170	watts

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class-B

MAXIMUM RATINGS (Per tube)

D-C PLATE VOLTAGE	3000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT	225 MAX. MA.
PLATE DISSIPATION	75 MAX. WATTS
GRID DISSIPATION	16 MAX. WATTS

TYPICAL OPERATION (Sinusoidal wave, two tubes unless otherwise specified)

D-C Plate Voltage	1000	1500	2000	volts
D-C Grid Voltage (approx.)[1]	—30	—60	—90	volts
Zero-Signal D-C Plate Current	90	67	50	ma.
Max-Signal D-C Plate Current	350	267	225	ma.
Effective Load, Plate-to-Plate	5300	11,400	19,300	ohms
Peak A-F Grid Input Voltage (per tube)	175	165	175	volts
Max-Signal Driving Power (approx.)	7	4	3	watts
Max-Signal Plate Dissipation (per tube)	75	75	75	watts
Max-Signal Plate Power Output	200	250	300	watts
Total Harmonic Distortion	1.5	2.0	2.0	per cent

[1] Adjust to give stated zero-signal plate current.

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER "TYPICAL OPERATION", POSSIBLY EXCEEDING MAXIMUM RATINGS, WRITE EITEL-McCULLOUGH, INC., FOR INFORMATION AND RECOMMENDATIONS.

APPLICATION

MECHANICAL

Mounting—The 75TH must be mounted vertically, base down or up. The plate and grid leads should be flexible. The tube must be protected from vibration and shock.

Cooling—Heat Dissipating Connectors (Eimac HR-3 and HR-2) should be used at the plate and grid terminals of the 75TH. If the free circulation of air around the tube is restricted, a small fan or centrifugal blower should be used to provide additional cooling for the plate and grid seals.

Cooling requirements will be met if the temperature of the plate and grid seals is not allowed to exceed 225°C. One method of measuring these temperatures is provided by the use of "Tempilaq", a temperature-sensitive lacquer available from the Tempil Corporation, New York 11, N.Y.

ELECTRICAL

Filament Voltage—For maximum tube life the filament voltage, as measured directly at the base pins, should be the rated value of 5.0 volts. Variations must be kept within the range of 4.75 to 5.25 volts.

Bias Voltage—Although there is no maximum limit on the bias voltage which may be used on the 75TH, there is little advantage in using bias voltages in excess of those given under "Typical Operation," except in certain very specialized applications. Where bias is obtained by a grid leak, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation.

Plate Voltage—The plate-supply voltage for the 75TH should not exceed 3000 volts. In most cases there is little advantage in using plate-supply voltages higher than those given under "Typical Operation" for the power output desired.

Grid Dissipation—The power dissipated by the grid of the 75TH must not exceed 16 watts. Grid dissipation may be calculated from the following expression:

$$P_g = e_{cmp} I_c$$

where P_g = Grid dissipation,
e_{cmp} = Peak positive grid voltage, and
I_c = D-c grid current.

e_{cmp} may be measured by means of a suitable peak voltmeter connected between filament and grid[1]. In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading.

Plate Dissipation—The plate of the 75TH operates at a visibly red temperature at its maximum rated dissipation of 75 watts. Plate dissipation in excess of the maximum rating is permissible only for short periods of time, such as during tuning procedures.

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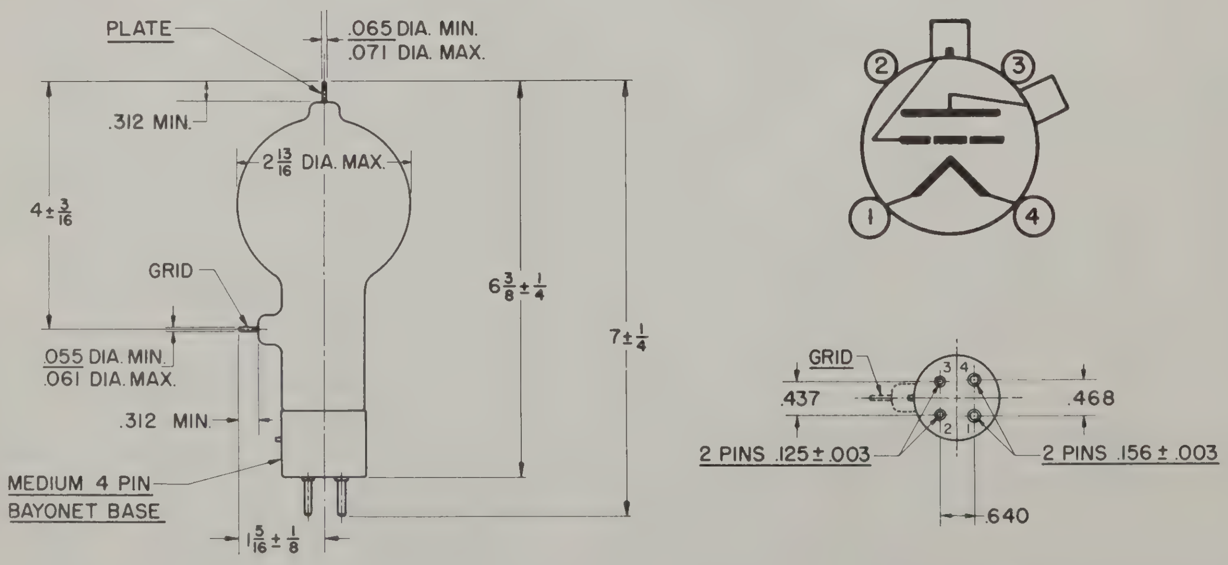
[1] For suitable peak v.t.v.m. circuits see, for instance, "Vacuum Tube Ratings", **Eimac News**, January, 1945. This article is available in reprint form on request.



BOTTOM VIEW

ALL DIMENSIONS IN INCHES

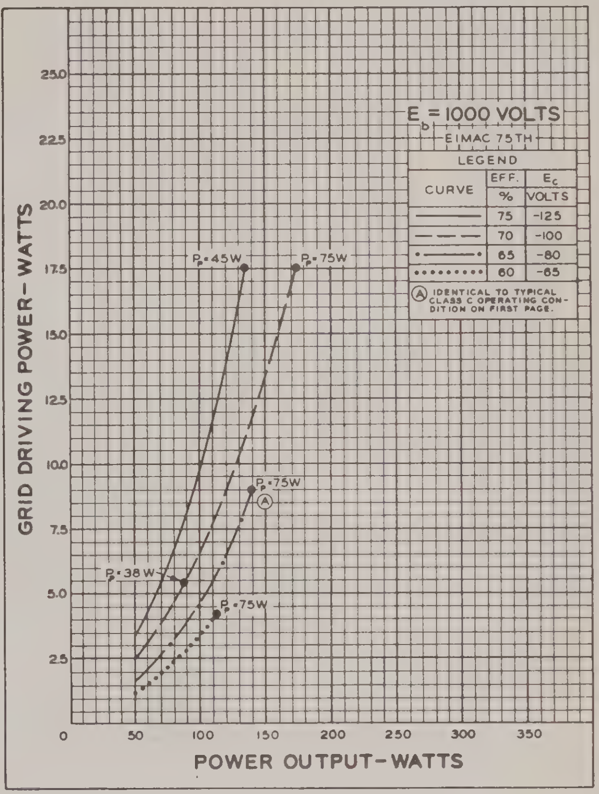
DRIVING POWER vs. POWER OUTPUT

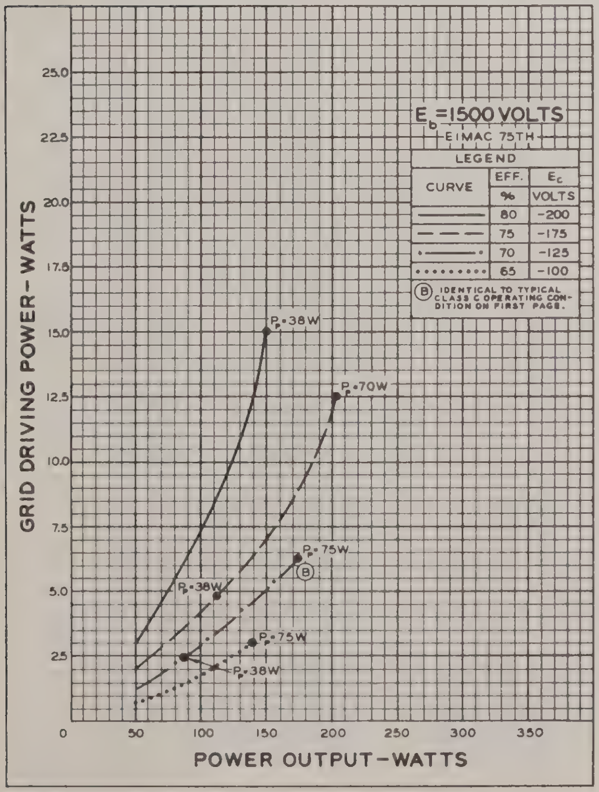
•

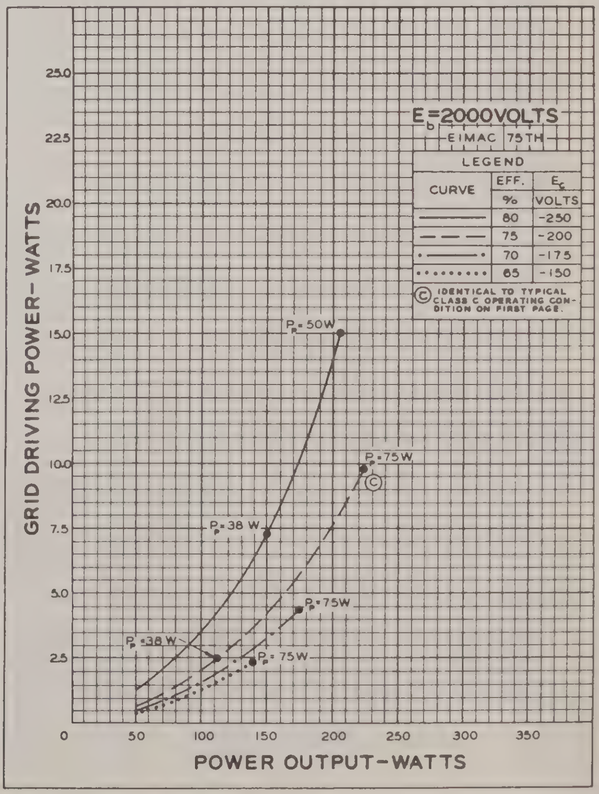
The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 1000, 1500 and 2000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

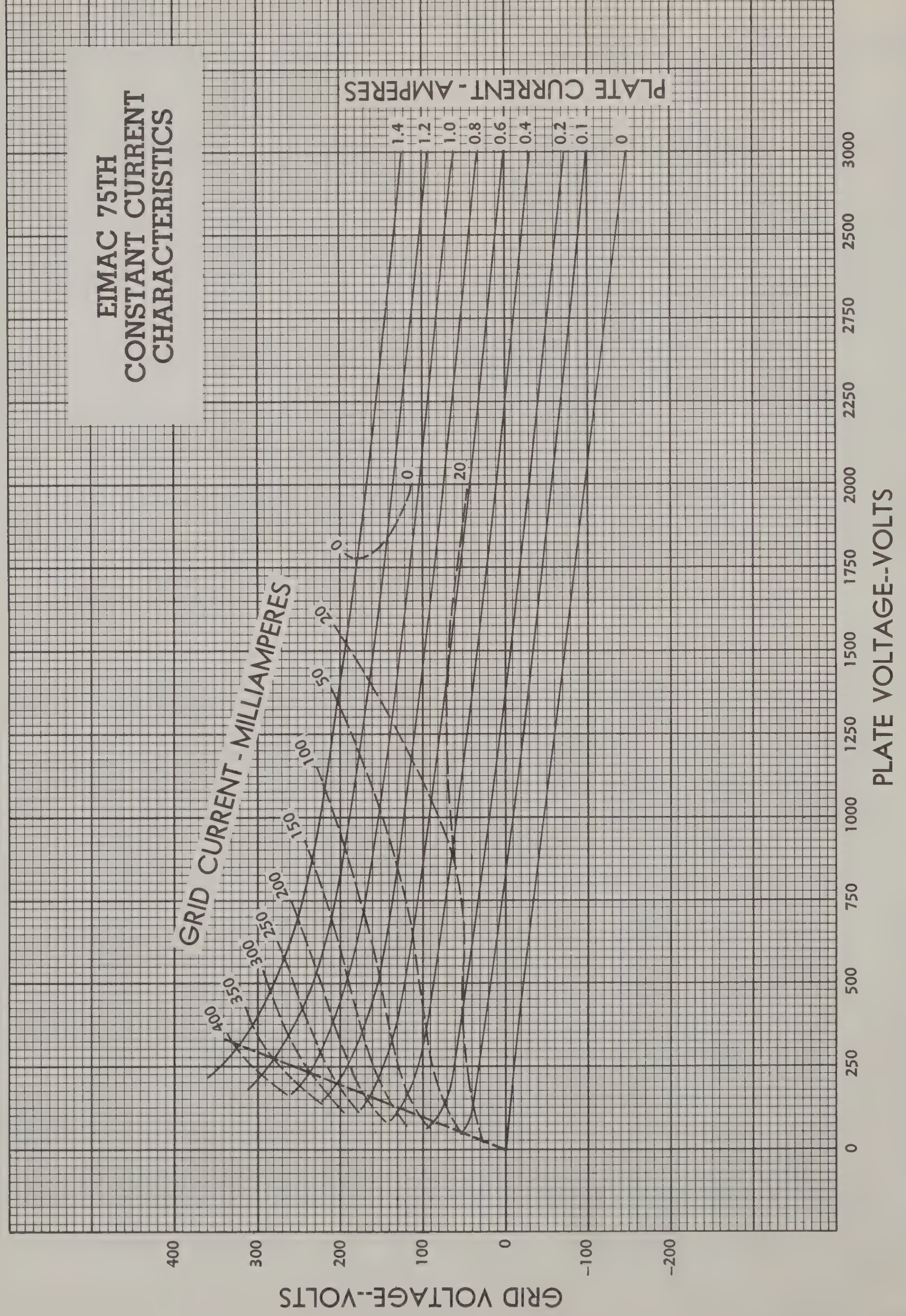
Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 1000, 1500, and 2000 volts respectively.

•









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Eimac®

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

75TL

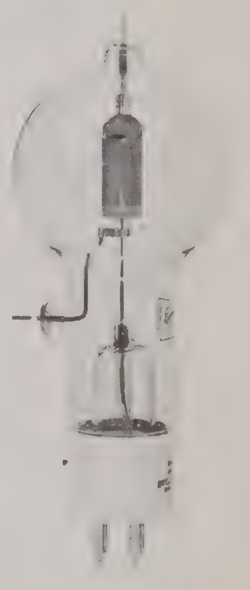
LOW-MU TRIODE

•

MODULATOR
OSCILLATOR
AMPLIFIER

The Eimac 75TL is a low-mu power triode intended for use as an amplifier, oscillator, or modulator. It has a maximum plate dissipation rating of 75 watts and a maximum plate voltage rating of 3000 volts at frequencies up to 40 Mc. Forced-air cooling is not required in properly designed equipment operating at frequencies below 40 Mc.

The 75TL in Class-C R-F service will deliver up to 225 watts plate power output with 8 watts driving power. Two 75TL's in Class-B modulator service will deliver up to 350 watts maximum-signal plate power output with 5 watts driving power.



GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated tungsten	
Voltage	5.0 volts
Current	6.25 amperes
Amplification Factor (Average)	12
Direct Interelectrode Capacitances (Average)	
Grid-Plate	2.4 μμf
Grid-Filament	2.6 μμf
Plate-Filament	0.4 μμf
Transconductance (I_b=225 ma., E_b=2500v.)	3350 μmhos
Highest Frequency for Maximum Ratings	40 Mc.

MECHANICAL

Base	Medium 4-pin bayonet
Basing	See outline drawing
Socket	Johnson type No. 122-224, National type No. XC-4 or CIR-4, or equivalent
Mounting Position	Vertical, base down or up
Cooling	Convection and radiation
Maximum Temperature of Plate and Grid Seals	225°C
Recommended Heat Dissipating Connectors:	
Plate	Eimac HR-3
Grid	Eimac HR-2
Maximum Overall Dimensions:	
Length	7.25 inches
Diameter	2.81 inches
Net Weight	3 ounces
Shipping Weight (Average)	1.5 pounds

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy (Key-down conditions, 1 tube)

MAXIMUM RATINGS (Frequencies up to 40 Mc.)

D-C PLATE VOLTAGE	3000 MAX. VOLTS
D-C PLATE CURRENT	225 MAX. MA.
PLATE DISSIPATION	75 MAX. WATTS
GRID DISSIPATION	13 MAX. WATTS

TYPICAL OPERATION (Frequencies up to 40 Mc.)

D-C Plate Voltage	1000	1500	2000	volts
D-C Grid Voltage	—150	—250	—300	volts
D-C Plate Current	215	167	150	ma.
D-C Grid Current	28	22	21	ma.
Peak R-F Grid Input Voltage (approx.)	320	355	425	volts
Driving Power (approx.)	8	6	8	watts
Plate Power Input	215	250	300	watts
Plate Dissipation	75	75	75	watts
Plate Power Output	140	175	225	watts

PLATE MODULATED RADIO FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS (Frequencies up to 40 Mc.)

D-C PLATE VOLTAGE	2400 MAX. VOLTS
D-C PLATE CURRENT	180 MAX. MA.
PLATE DISSIPATION	50 MAX. WATTS
GRID DISSIPATION	13 MAX. WATTS

TYPICAL OPERATION (Frequencies up to 40 Mc.)

D-C Plate Voltage	1000	1500	2000	volts
Total Bias Voltage	—250	—370	—500	volts
Fixed Bias Voltage	—130	—260	—380	volts
Grid Resistor	7500	6000	6000	ohms
D-C Plate Current	135	130	130	ma.
D-C Grid Current (approx.)	16	18	20	ma.
Peak R-F Grid Input Voltage (approx.)	410	545	695	volts
Driving Power (approx.)	6	10	14	watts
Grid Dissipation	2	3	4	watts
Plate Power Input	135	195	260	watts
Plate Dissipation	50	50	50	watts
Plate Power Output	85	145	210	watts

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class—AB_1

MAXIMUM RATINGS (Per tube)

D-C PLATE VOLTAGE	3000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT	225 MAX. MA.
PLATE DISSIPATION	75 MAX. WATTS

TYPICAL OPERATION (Sinusoidal wave, two tubes unless otherwise specified)

D-C Plate Voltage	1500	2000	volts
D-C Grid Voltage[1]	—130	—190	volts
Peak A-F Grid Input Voltage (per tube)	130	190	volts
Zero-Signal D-C Plate Current	67	50	ma.
Max-Signal D-C Plate Current	143	130	ma.
Driving Power	0	0	watt
Effective Load, Plate-to-Plate	10,200	21,200	ohms
Max-Signal Plate Power Output	64	110	watts
Max-Signal Plate Dissipation (per tube)	75	75	watts
Total Harmonic Distortion	3.0	3.5	per cent

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER "TYPICAL OPERATION", POSSIBLY EXCEEDING MAXIMUM RATINGS, WRITE EITEL-McCULLOUGH, INC., FOR INFORMATION AND RECOMMENDATIONS.

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AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class—AB$_2$

MAXIMUM RATINGS (Per tube)

D-C PLATE VOLTAGE	3000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT	225 MAX. MA.
PLATE DISSIPATION	75 MAX. WATTS
GRID DISSIPATION	13 MAX. WATTS

TYPICAL OPERATION (Sinusoidal wave, two tubes unless otherwise specified)

D-C Plate Voltage	1000	1500	2000	volts
D-C Grid Voltage[1]	—70	—130	—190	volts
Peak A-F Grid Input Voltage (per tube)	215	250	300	volts
Zero-Signal D-C Plate Current	100	67	50	ma.
Max-Signal D-C Plate Current	350	285	250	ma.
Max-Signal Avg. Driving Power (approx.)	7	6	5	watts
Max-Signal Peak Driving Power	26	23	19	watts
Effective Load, Plate-to-Plate	5300	11,000	18,000	ohms
Max-Signal Plate Power Output	200	280	350	watts
Max-Signal Plate Dissipation (per tube)	75	75	75	watts
Total Harmonic Distortion	2.0	4.5	6.0	per cent

[1] Adjust to give stated zero-signal plate current. The effective grid-circuit resistance for each tube must not exceed 250,000 ohms in class-AB$_1$ operation.

APPLICATION

MECHANICAL

Mounting—The 75TL must be mounted vertically, base down or up. The plate and grid leads should be flexible. The tube must be protected from vibration and shock.

Cooling—Heat Dissipating Connectors (Eimac HR-3 and HR-2) should be used at the plate and grid terminals of the 75TL. If the free circulation of air around the tube is restricted, a small fan or centrifugal blower should be used to provide additional cooling for the plate and grid seals.

Cooling requirements will be met if the temperature of the plate and grid seals is not allowed to exceed 225°C. One method of measuring these temperatures is provided by the use of "Tempilaq", a temperature-sensitive lacquer available from the Tempil Corporation, New York 11, N.Y.

ELECTRICAL

Filament Voltage—For maximum tube life the filament voltage, as measured directly at the base pins, should be the rated value of 5.0 volts. Variations must be kept within the range of 4.75 to 5.25 volts.

Bias Voltage—Although there is no maximum limit on the bias voltage which may be used on the 75TL, there is little advantage in using bias voltages in excess of those given under "Typical Operation," except in certain very specialized applications. Where bias is obtained by a grid leak, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation.

Plate Voltage—The plate-supply voltage for the 75TL should not exceed 3000 volts. In most cases there is little advantage in using plate-supply voltages higher than those given under "Typical Operation" for the power output desired.

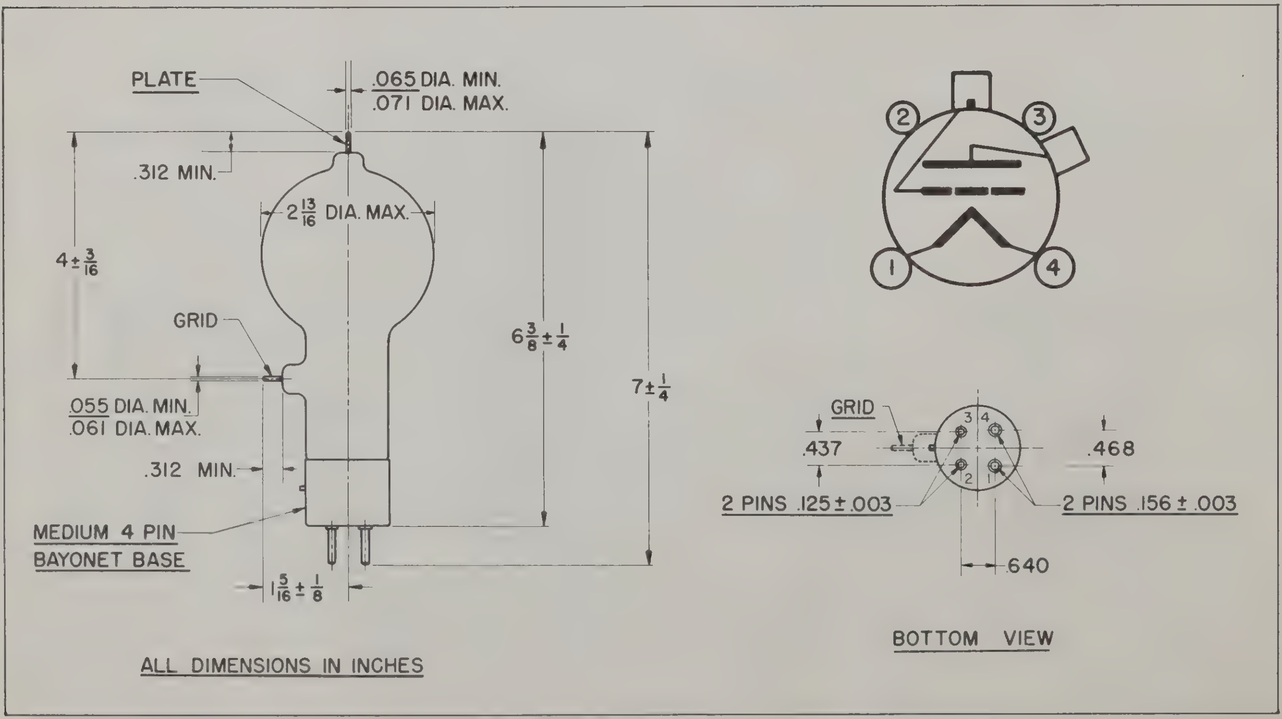
Grid Dissipation—The power dissipated by the grid of the 75TL must not exceed 13 watts. Grid dissipation may be calculated from the following expression:

$$P_g = e_{cmp} I_c$$

where P_g = Grid dissipation,
e_{cmp} = Peak positive grid voltage, and
I_c = D-c grid current.

e_{cmp} may be measured by means of a suitable peak voltmeter connected between filament and grid. In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading.

Plate Dissipation—The plate of the 75TL operates at a visibly red temperature at its maximum rated dissipation of 75 watts. Plate dissipation in excess of the maximum rating is permissible only for short periods of time, such as during tuning procedures.



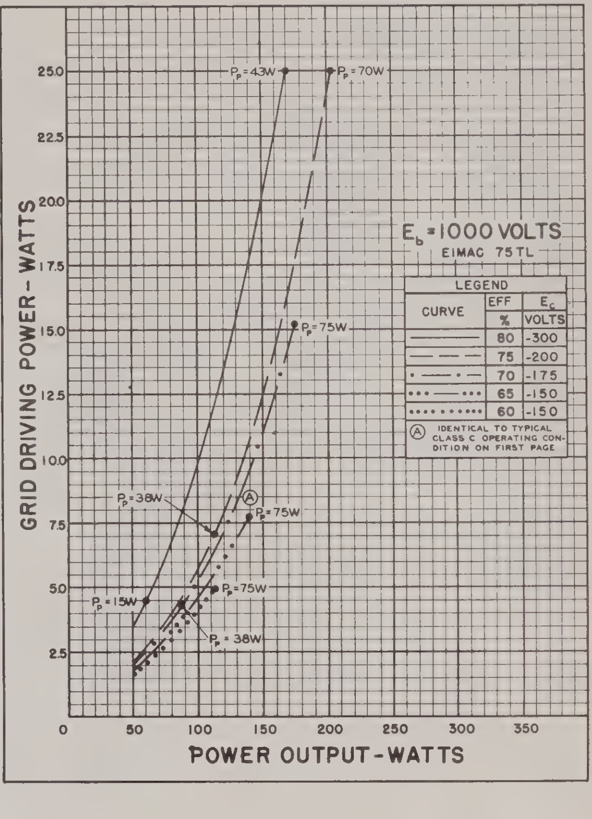
DRIVING POWER vs. POWER OUTPUT

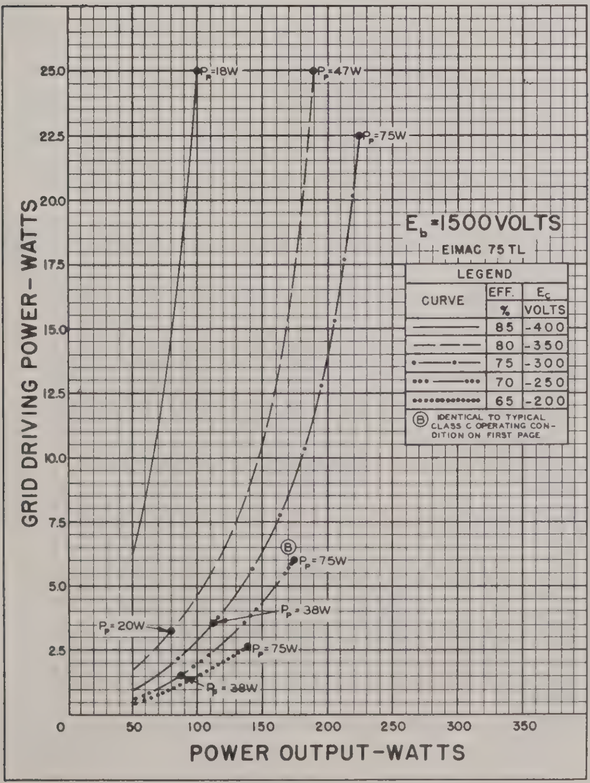
●

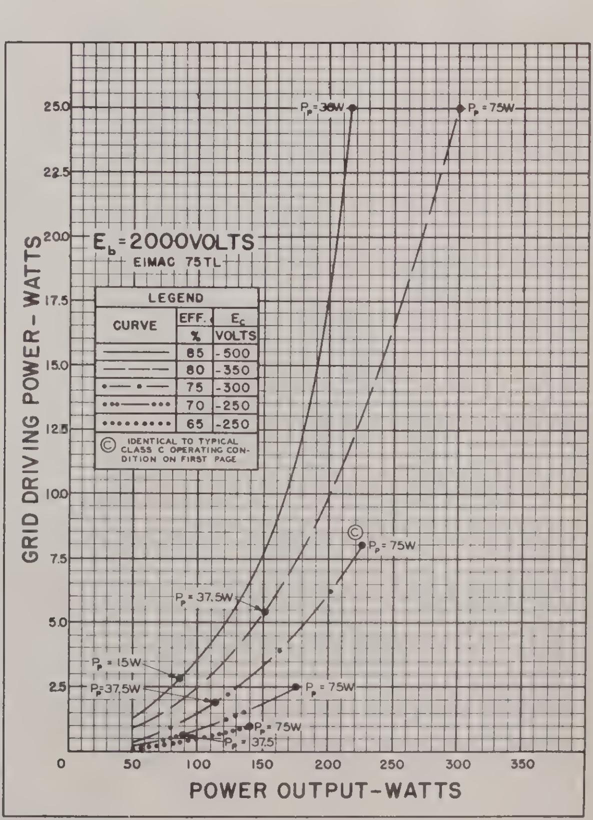
The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 1000, 1500 and 2000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

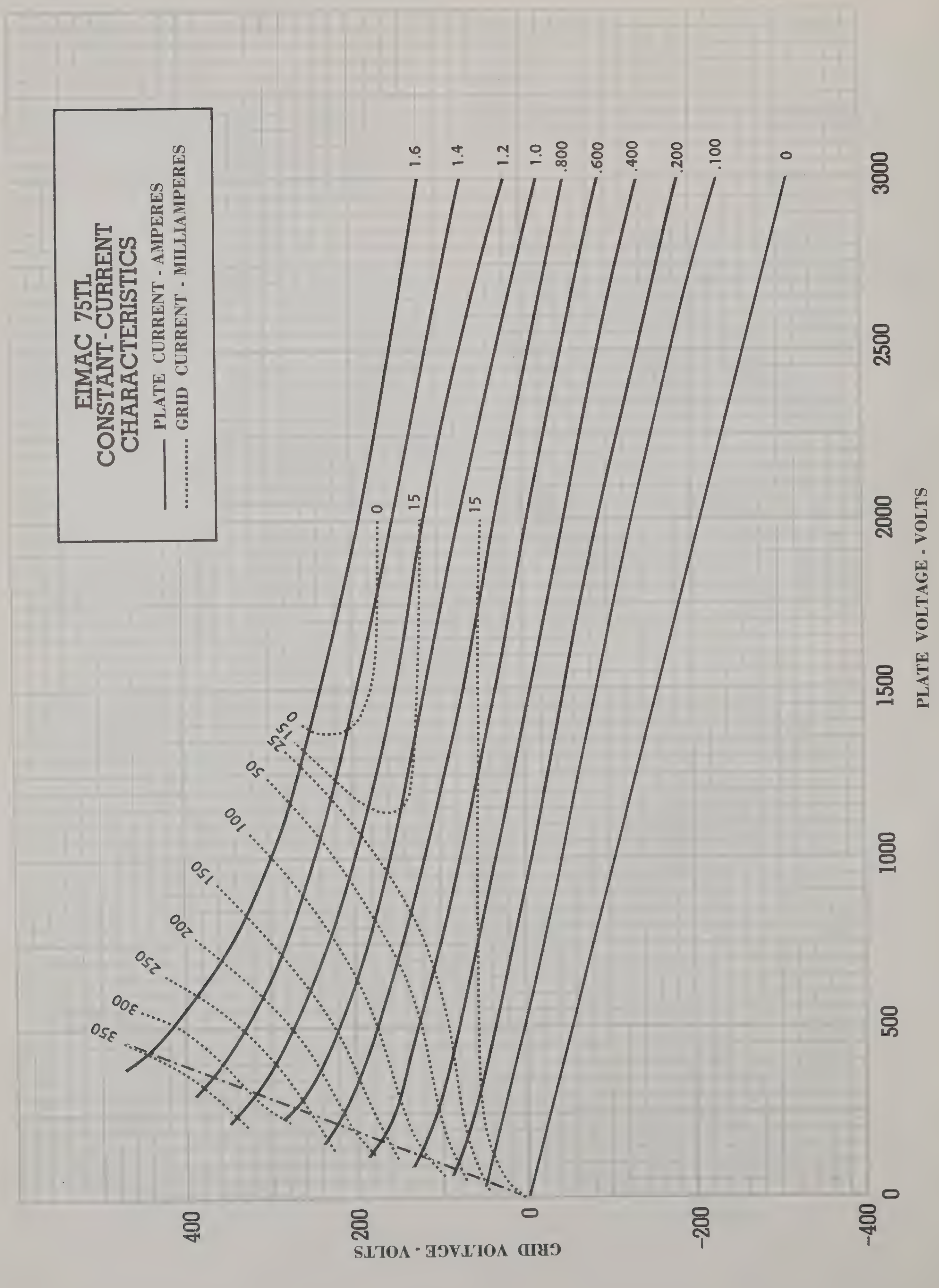
Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 1000, 1500, and 2000 volts respectively.

●







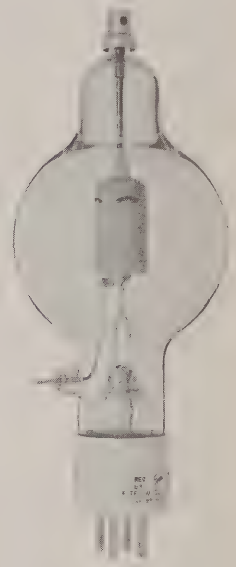

EIMAC 75TL
CONSTANT-CURRENT CHARACTERISTICS
PLATE CURRENT - AMPERES
GRID CURRENT - MILLIAMPERES
1.6
1.4
1.2
1.0
.800
.600
.400
.200
.100
0
0
15
15
0
15
25
50
100
150
200
250
300
350
400
200
0
-200
-400
GRID VOLTAGE - VOLTS
0
500
1000
1500
2000
2500
3000
PLATE VOLTAGE - VOLTS

EITEL-McCULLOUGH, INC.

100TH

HIGH-MU TRIODE

MODULATOR
OSCILLATOR
AMPLIFIER



The Eimac 100TH is a high-mu power triode having a maximum plate dissipation rating of 100 watts, and is intended for use as an amplifier, oscillator, or modulator. It can be used at its maximum ratings at frequencies as high as 40-Mc.

Cooling of the 100TH is accomplished by radiation from the plate, which operates at a visible red color at maximum dissipation, and by means of air circulation by convection around the envelope.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated tungsten	
Voltage	5.0 volts
Current	6.3 amperes
Amplification Factor (Average)	38
Direct Interelectrode Capacitances (Average)	
Grid-Plate	2.0 μμf
Grid-Filament	2.9 μμf
▶ Plate-Filament	0.3 μμf
Transconductance (i_b=200 ma., E_b=3000v., e_c= –5v.)	4500 μmhos
Frequency for Maximum Ratings	40 Mc.

MECHANICAL

Base (Medium 4-pin bayonet, ceramic)	RMA type M8-078
Basing	RMA type 2M
Mounting	Vertical, base down or up.
Cooling	Convection and Radiation.
Recommended Heat Dissipating Connectors:	
Plate	Eimac HR-6
Grid	Eimac HR-2
Maximum Overall Dimensions:	
Length	7.75 inches
Diameter	3.19 inches
Net weight	4 ounces
Shipping weight (Average)	1.5 pounds

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class-AB₂ (Sinusoidal wave, two tubes unless otherwise specified)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	3000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT, PER TUBE	225 MAX. MA.
PLATE DISSIPATION, PER TUBE	100 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	1500	2000	2500	Volts
D-C Grid Voltage (approx.)*	—20	—35	—50	Volts
Zero-Signal D-C Plate Current	80	60	48	Ma.
Max-Signal D-C Plate Current	320	280	250	Ma.
Effective Load, Plate-to-Plate	8800	15,000	22,000	Ohms.
Peak A-F Grid Input Voltage (per tube)	145	150	155	Volts
Max-Signal Peak Driving Power	18	19	15	Watts
Max-Signal Nominal Driving Power (approx.)	9	9.5	7.5	Watts
Max-Signal Plate Power Output	280	360	425	Watts

*Adjust to give stated zero signal plate current.

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony
(Key-down conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	3000 MAX. VOLTS
D-C PLATE CURRENT	225 MAX. MA.
PLATE DISSIPATION	100 MAX. WATTS
GRID DISSIPATION	20 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	1500	2000	3000	Volts
D-C Grid Voltage	—65	—80	—200	Volts
D-C Plate Current	190	165	165	Ma.
D-C Grid Current	48	39	51	Ma.
Peak R-F Grid Input Voltage	230	230	385	Volts
Driving Power (approx.)	10	8	18	Watts
Grid Dissipation	7	5	10	Watts
Plate Power Input	285	335	500	Watts
Plate Dissipation	100	100	100	Watts
Plate Power Output	185	235	400	Watts

PLATE MODULATED RADIO FREQUENCY AMPLIFIER

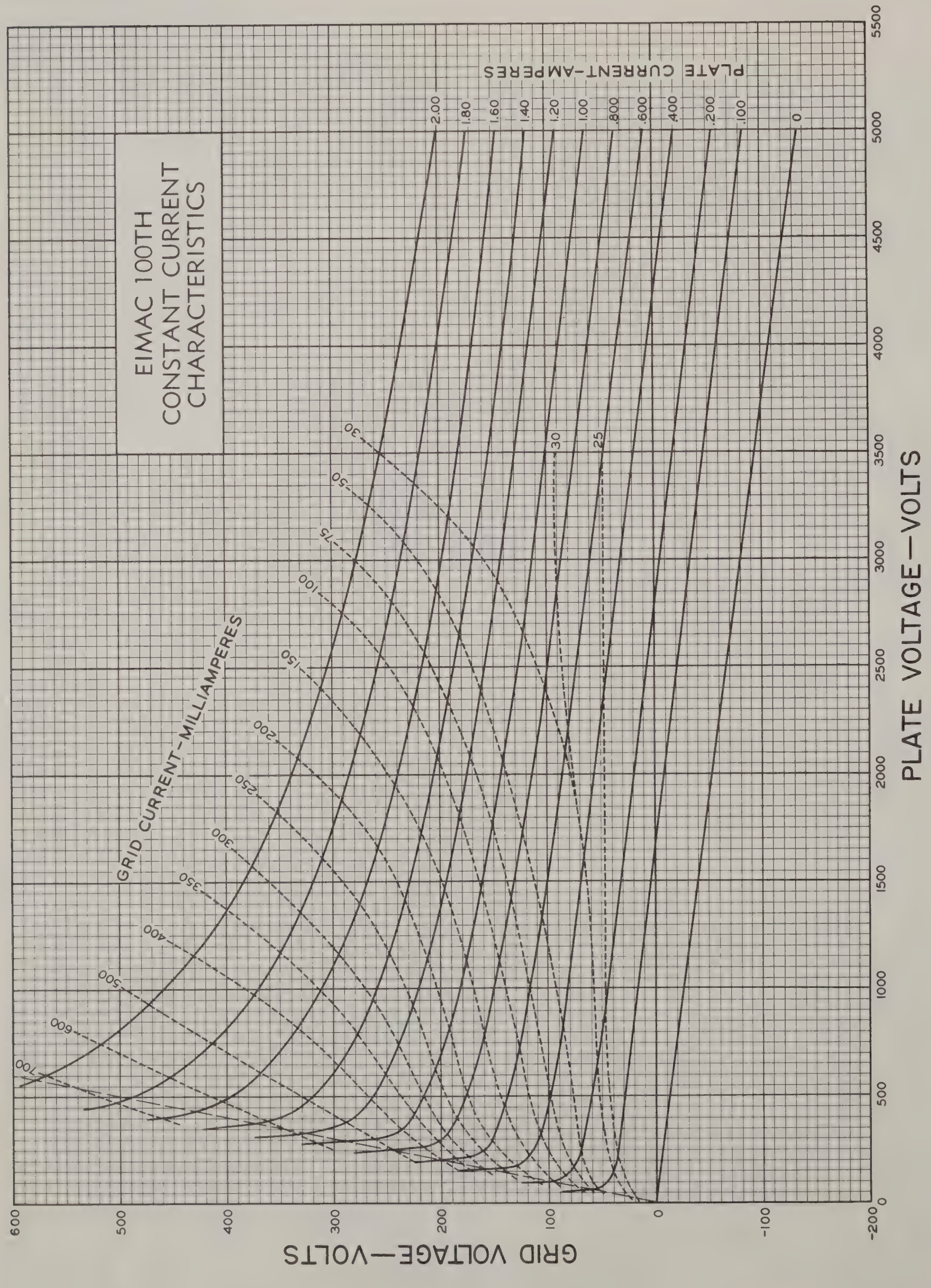
Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	2500 MAX. VOLTS
D-C PLATE CURRENT	180 MAX. MA.
PLATE DISSIPATION	65 MAX. WATTS
GRID DISSIPATION	20 MAX. WATTS

TYPICAL OPERATION

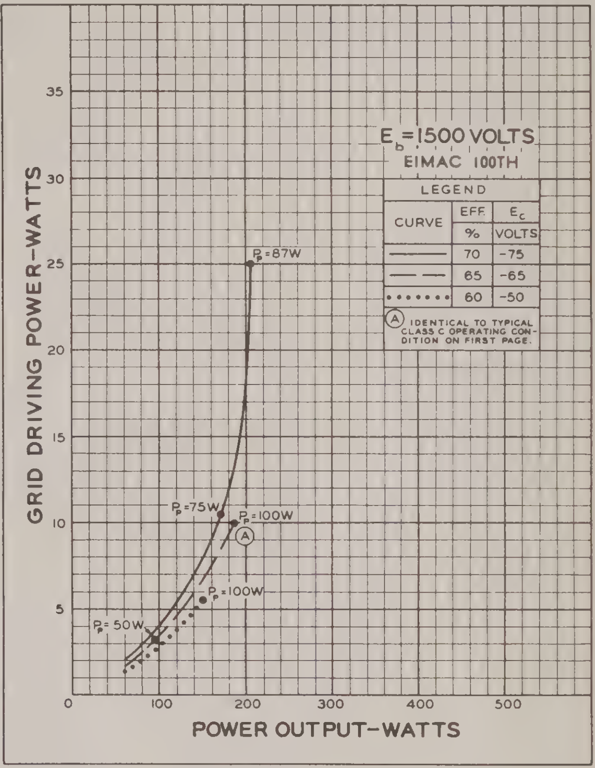
D-C Plate Voltage	1500	2000	2500	Volts
D-C Grid Voltage	—150	—200	—250	Volts
D-C Plate Current	160	150	140	Ma.
D-C Grid Current	46	41	40	Ma.
Peak R-F Grid Input Voltage	325	375	425	Volts
Driving Power (approx.)	15	15.5	17	Watts
Grid Dissipation	8	7.3	7	Watts
Plate Power Input	240	300	350	Watts
Plate Dissipation	65	65	65	Watts
Plate Power Output	175	235	285	Watts

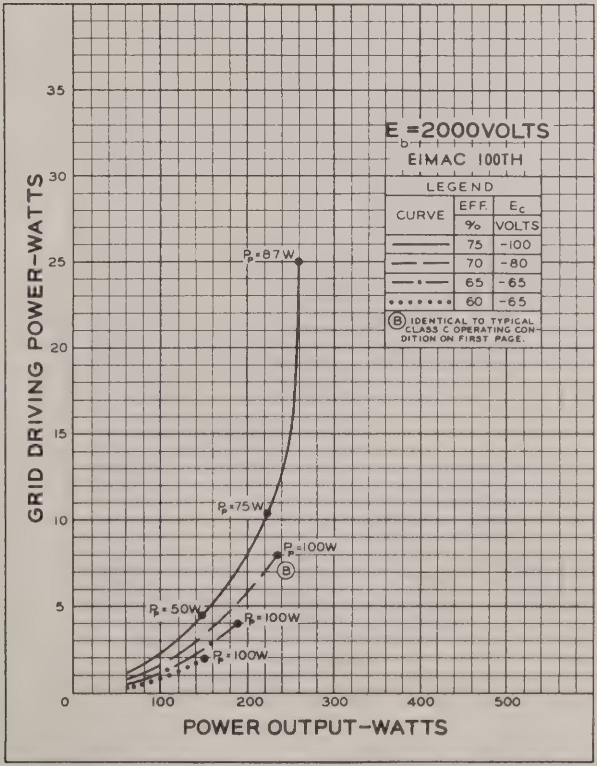

EIMAC 100TH
CONSTANT CURRENT
CHARACTERISTICS
PLATE CURRENT-AMPERES
2.00
1.80
1.60
1.40
1.20
1.00
.800
.600
.400
.200
.100
0
GRID CURRENT-MILLIAMPERES
30
50
75
100
150
200
250
300
350
400
500
600
700
30
25
PLATE VOLTAGE—VOLTS
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
GRID VOLTAGE—VOLTS
600
500
400
300
200
100
0
-100
-200

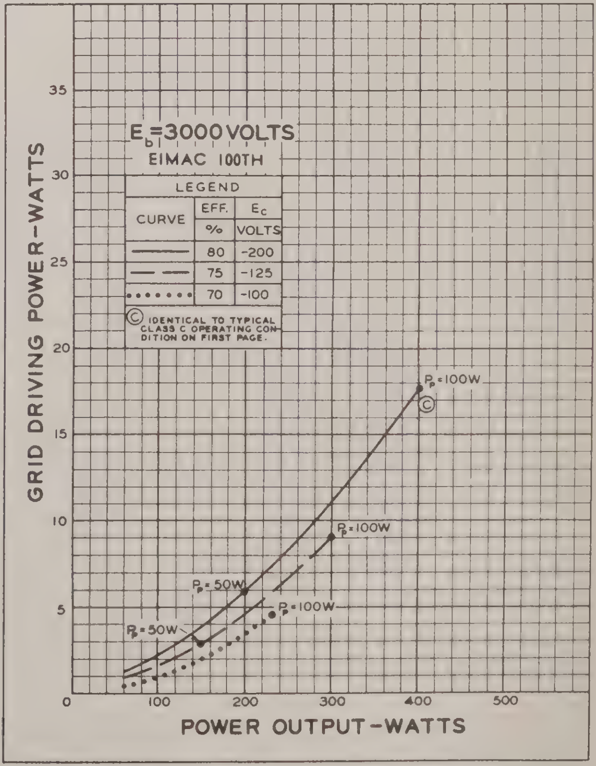
DRIVING POWER vs. POWER OUTPUT

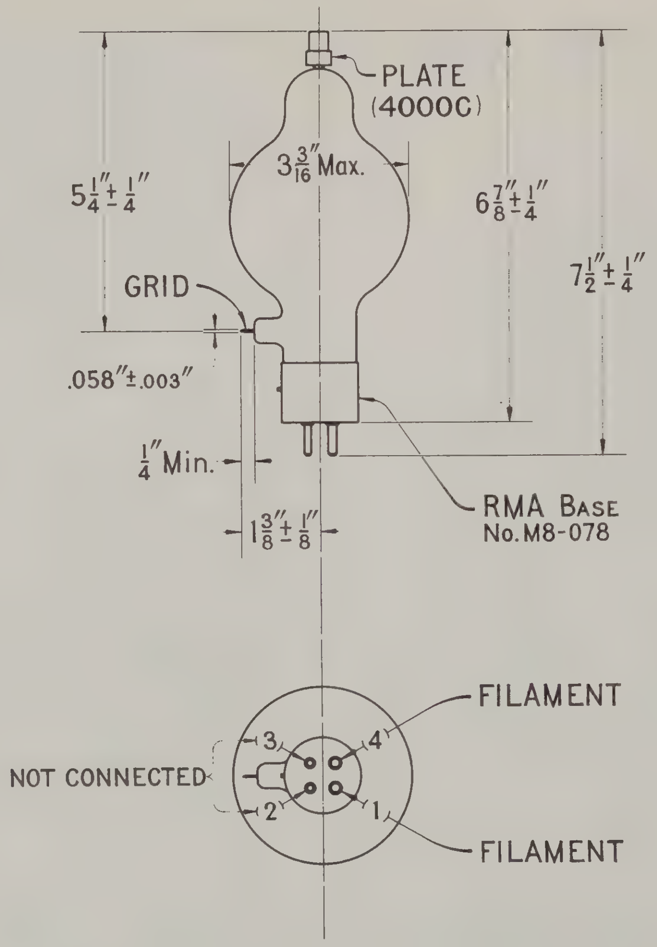
The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 1500, 2000 and 3000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 1500, 2000, and 3000 volts respectively.









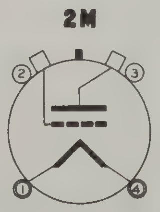
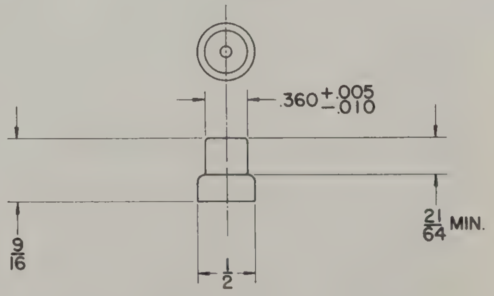


PLATE CAP
NO. 4000C



GRID CAP
(SEE TUBE OUTLINE DRAWING)

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Eimac®

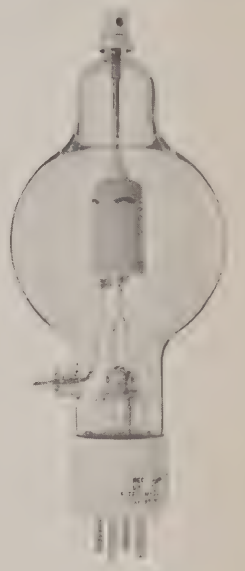
EITEL-McCULLOUGH, INC.
SAN CARLOS CALIFORNIA

100TL

LOW-MU TRIODE

●

MODULATOR
OSCILLATOR
AMPLIFIER



The Eimac 100TL is a low-mu power triode having a maximum plate dissipation rating of 100 watts, and is intended for use as an amplifier, oscillator or modulator. It can be used at its maximum ratings at frequencies as high as 40-Mc.

Cooling of the 100TL is accomplished by radiation from the plate, which operates at a visible red color at maximum dissipation, and by means of air circulation by convection around the envelope.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated tungsten	
Voltage	5.0 volts
Current	6.3 amperes
Amplification Factor (Average)	14
Direct Interelectrode Capacitances (Average)	
Grid-Plate	2.0 $\mu\mu$f
Grid-Filament	2.3 $\mu\mu$f
Plate-Filament	0.4 $\mu\mu$f
Transconductance (i_b=225 ma., E_b=3000v., e_c=−90v.)	3000 μmhos
Frequency for Maximum Ratings	40 Mc.

MECHANICAL

Base (Medium 4-pin bayonet, ceramic)	RMA type M8-078
Basing	RMA type 2M
Mounting	Vertical, base down or up.
Cooling	Convection and Radiation.
Recommended Heat Dissipating Connectors:	
Plate	Eimac HR-6
Grid	Eimac HR-2
Maximum Overall Dimensions:	
Length	7.75 inches
Diameter	3.19 inches
Net weight	4 ounces
Shipping weight (Average)	1.5 pounds

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class-AB₂ (Sinusoidal wave, two tubes unless otherwise specified)

MAXIMUM RATINGS	
D-C PLATE VOLTAGE	3000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT, PER TUBE	225 MAX. MA.
PLATE DISSIPATION, PER TUBE	100 MAX. WATTS

TYPICAL OPERATION			
D-C Plate Voltage	1500	2000	2500 Volts
D-C Grid Voltage (approx.)*	—65	—110	—145 Volts
Zero-Signal D-C Plate Current	80	60	48 Ma.
Max-Signal D-C Plate Current	320	280	250 Ma.
Effective Load, Plate-to-Plate	8800	15,000	22,000 Ohms
Peak A-F Grid Input Voltage (per tube)	235	270	290 Volts
Max-Signal Peak Driving Power	21	22	20 Watts
Max-Signal Nominal Driving Power (approx.)	10.5	11	10 Watts
Max-Signal Plate Power Output	280	360	425 Watts

*Adjust to give stated zero signal plate current.

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony
(Key-down conditions, per tube)

MAXIMUM RATINGS	
D-C PLATE VOLTAGE	3000 MAX. VOLTS
D-C PLATE CURRENT	225 MAX. MA.
PLATE DISSIPATION	100 MAX. WATTS
GRID DISSIPATION	15 MAX. WATTS

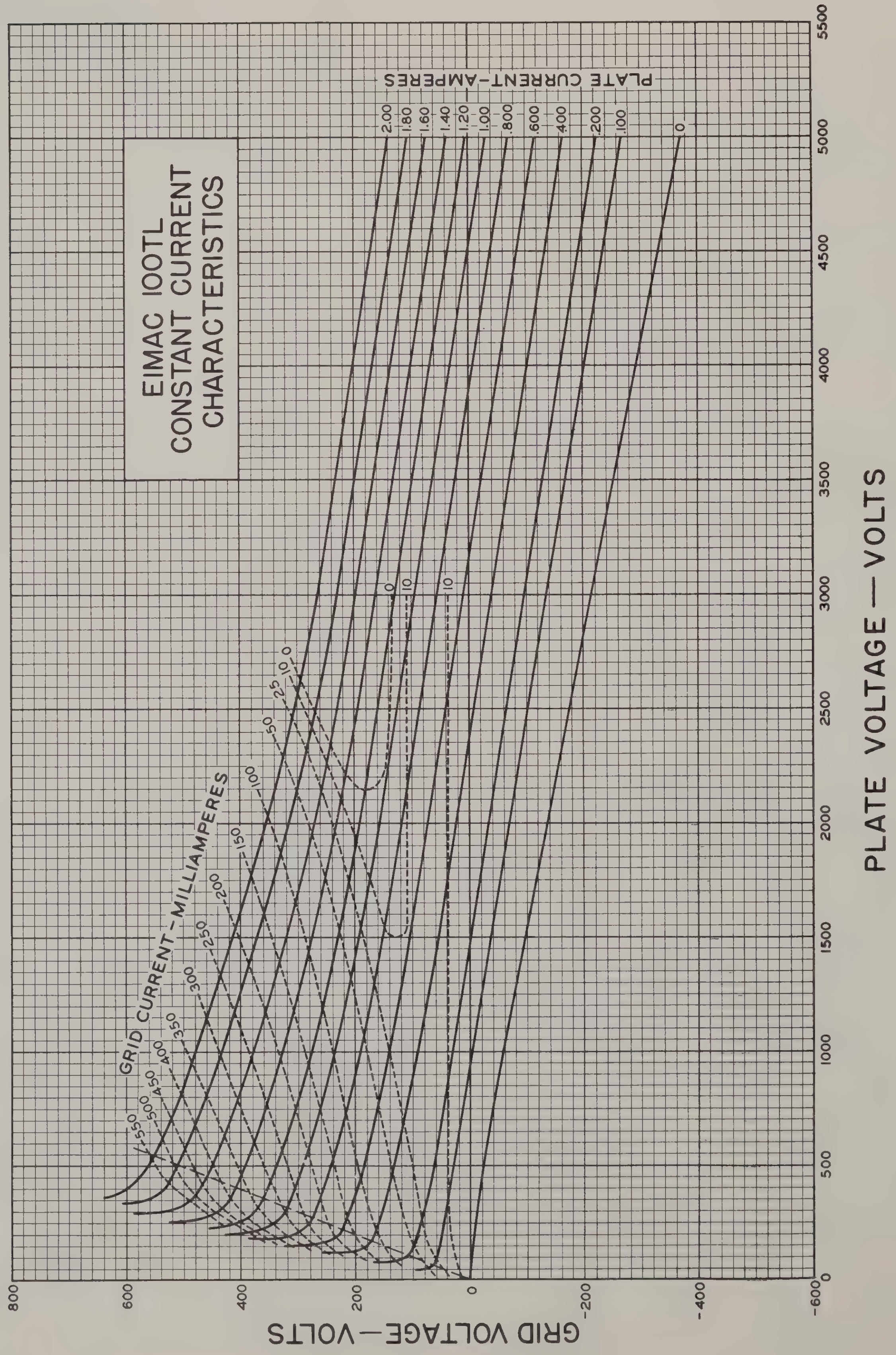
TYPICAL OPERATION			
D-C Plate Voltage	1500	2000	3000 Volts
D-C Grid Voltage	—175	—225	—400 Volts
D-C Plate Current	190	165	165 Ma.
D-C Grid Current	37	28	30 Ma.
Peak R-F Grid Input Voltage	425	450	650 Volts
Driving Power (approx.)	14	11	20 Watts
Grid Dissipation	7.5	5	8 Watts
Plate Power Input	285	335	500 Watts
Plate Dissipation	100	100	100 Watts
Plate Power Output	185	235	400 Watts

PLATE MODULATED RADIO FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS	
D-C PLATE VOLTAGE	2500 MAX. VOLTS
D-C PLATE CURRENT	180 MAX. MA.
PLATE DISSIPATION	65 MAX. WATTS
GRID DISSIPATION	15 MAX. WATTS

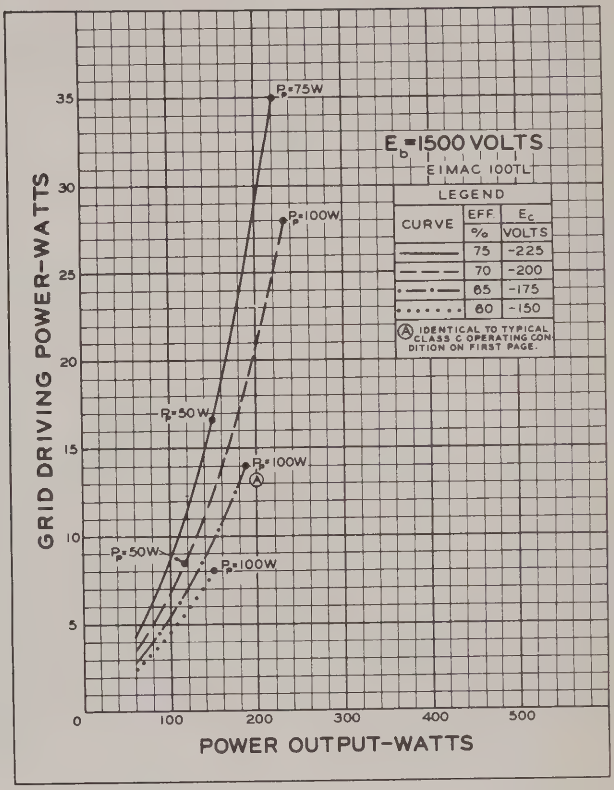
TYPICAL OPERATION			
D-C Plate Voltage	1500	2000	2500 Volts
D-C Grid Voltage	—300	—400	—500 Volts
D-C Plate Current	160	150	140 Ma.
D-C Grid Current	32	31	31 Ma.
Peak R-F Grid Input Voltage	530	655	750 Volts
Driving Power (approx.)	17	20	23 Watts
Grid Dissipation	8	7.5	7.5 Watts
Plate Power Input	240	300	350 Watts
Plate Dissipation	65	65	65 Watts
Plate Power Output	175	235	285 Watts

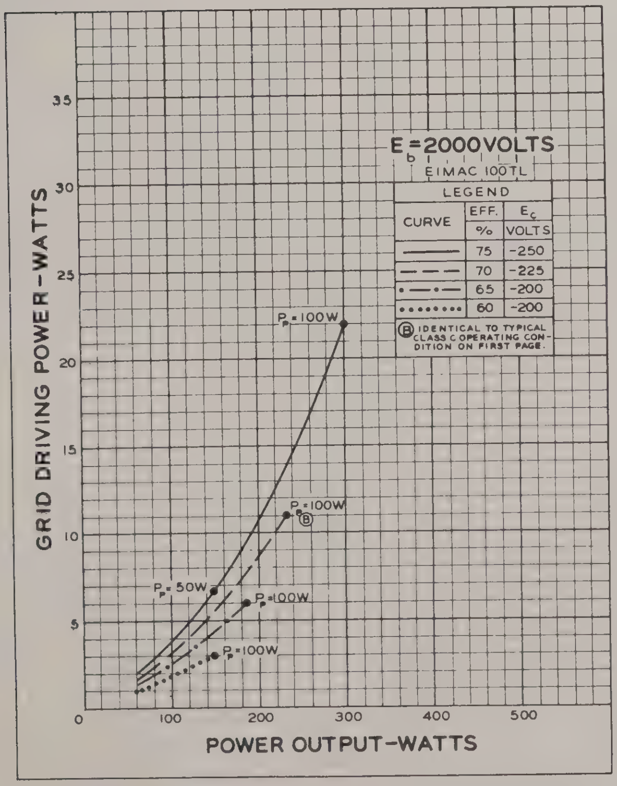

EIMAC 100TL
CONSTANT CURRENT
CHARACTERISTICS
PLATE CURRENT-AMPERES
2.00
1.80
1.60
1.40
1.20
1.00
.800
.600
.400
.200
.100
0
GRID CURRENT - MILLIAMPERES
550
500
450
400
350
300
250
200
150
100
50
25
10
0
0
10
10
PLATE VOLTAGE — VOLTS
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
GRID VOLTAGE — VOLTS
800
600
400
200
0
-200
-400
-600

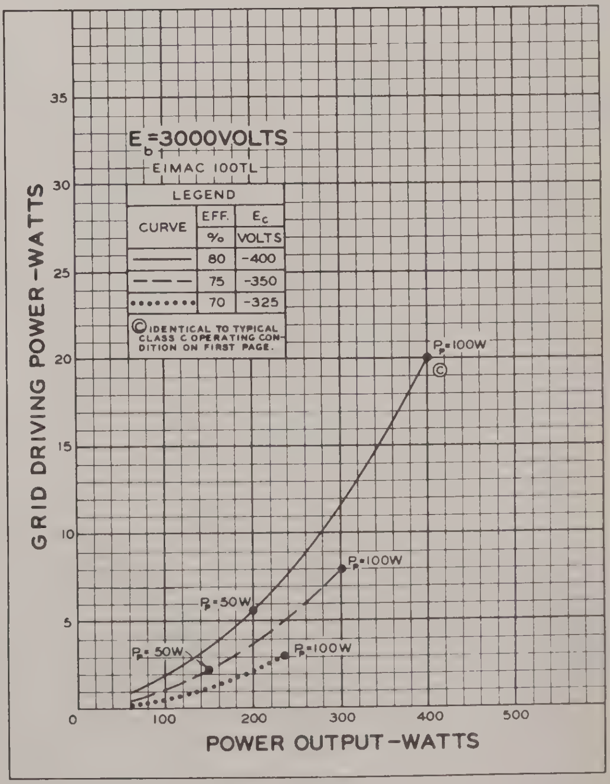
DRIVING POWER vs. POWER OUTPUT

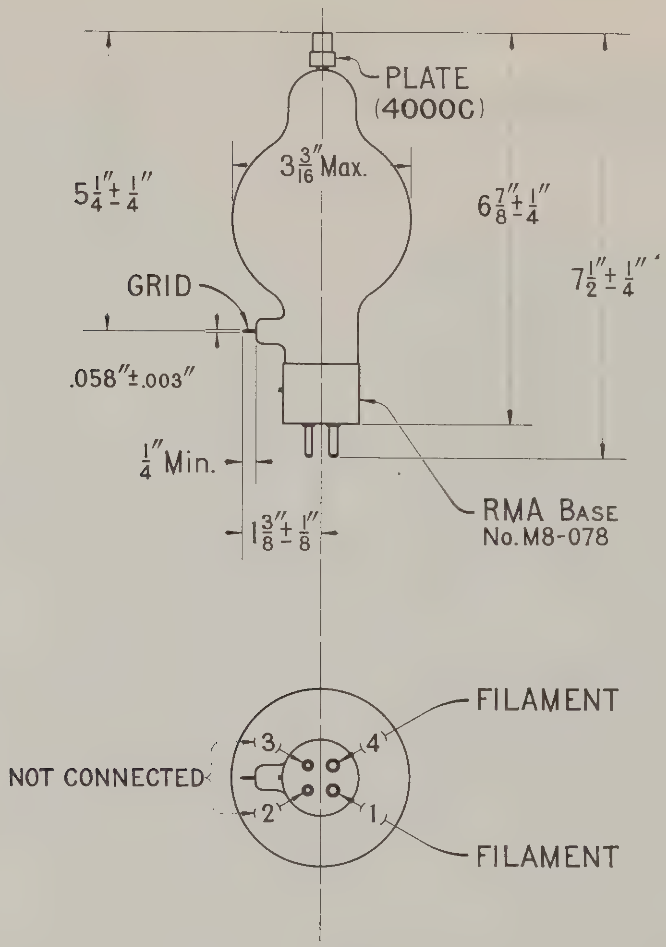
The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 1500, 2000 and 3000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 1500, 2000, and 3000 volts respectively.









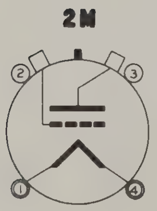
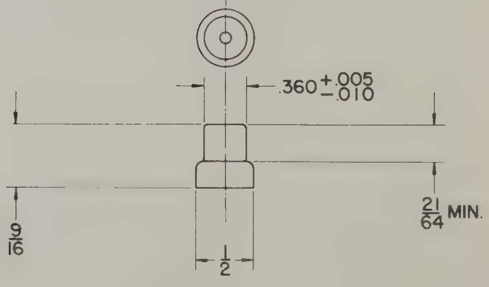


PLATE CAP
NO. 4000C



GRID CAP
(SEE TUBE OUTLINE DRAWING)

Eimac®

EITEL-McCULLOUGH, INC.
SAN CARLOS CALIFORNIA

152TH

MEDIUM-MU TRIODE
MODULATOR
OSCILLATOR
AMPLIFIER

The Eimac 152TH is a medium-mu power triode intended for use as an amplifier, oscillator, or modulator. It has a maximum plate-dissipation rating of 150 watts and a maximum plate-voltage rating of 3000 volts at frequencies up to 40 Megacycles.

The 152TH in class-C r-f service will deliver up to 600 watts plate output power with 27 watts driving power. Two 152TH's in class-B modulator service will deliver up to 600 watts maximum-signal plate output power with 8 watts nominal driving power.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten		
Voltage	5.0 or 10.0	volts
Current	12.5 or 6.25	amperes
Amplification Factor (Average)	20	
Direct Interelectrode Capacitances (Average)		
Grid-Plate	4.8	uufd
Grid-Filament	5.7	uufd
Plate-Filament	0.4	uufd
Transconductance (I_b=500 ma, E_b=3000 v)	8300	umhos
Highest Frequency for Maximum Ratings	40	mc

MECHANICAL

Base	Special 4-pin
Basing	See outline drawing
Socket	Johnson type No. 124-213 or equivalent
Mounting Position	Vertical, base down or up
Cooling	Convection and radiation
Maximum Temperature of Plate and Grid Seals	225° C
Recommended Heat-Dissipating Connectors:	
Plate	Eimac HR-5
Grid	Eimac HR-6
Maximum Over-All Dimensions:	
Length	7.63 inches
Diameter	2.57 inches
Net Weight	8 ounces
Shipping Weight (Approximate)	1.25 pounds

RADIO-FREQUENCY POWER AMPLIFIER OR OSCILLATOR

Class-C Telegraphy (Key-down conditions, one tube)

MAXIMUM RATINGS (Frequencies up to 40 Mc.)

D-C PLATE VOLTAGE	3000 MAX. VOLTS
D-C PLATE CURRENT	450 MAX. MA
PLATE DISSIPATION	150 MAX. WATTS
GRID DISSIPATION	30 MAX. WATTS

TYPICAL OPERATION (Frequencies up to 40 Mc)

D-C Plate Voltage	1500	2000	3000	volts
D-C Grid Voltage	—125	—200	—300	volts
D-C Plate Current	335	300	250	ma
D-C Grid Current*	58	75	70	ma
Peak R-F Grid Voltage	265	335	410	volts
Driving Power*	13	20	27	watts
Plate Input Power	500	600	750	watts
Plate Dissipation	150	150	150	watts
Plate Output Power	350	450	600	watts

PLATE-MODULATED RADIO-FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS (Frequencies up to 40 Mc.)

D-C PLATE VOLTAGE	2500 MAX. VOLTS
D-C PLATE CURRENT	350 MAX. MA
PLATE DISSIPATION	100 MAX. WATTS
GRID DISSIPATION	30 MAX. WATTS

TYPICAL OPERATION (Frequencies up to 40 Mc)

D-C Plate Voltage	1000	1500	2000	2500	volts
D-C Grid Voltage	—150	—200	—300	—350	volts
D-C Plate Current	270	235	220	200	ma
D-C Grid Current*	40	28	30	30	ma
Peak R-F Grid Voltage	300	330	440	485	volts
Driving Power*	12	10	12	15	watts
Grid Dissipation*	6	4	4	4	watts
Plate Input Power	270	350	440	500	watts
Plate Dissipation	100	100	100	100	watts
Plate Output Power	170	250	340	400	watts

AUDIO-FREQUENCY POWER AMPLIFIER OR MODULATOR

Class-B

MAXIMUM RATINGS (per tube)

D-C PLATE VOLTAGE	3000 MAX. VOLTS
D-C PLATE CURRENT	450 MAX. MA
PLATE DISSIPATION	150 MAX. WATTS

TYPICAL OPERATION
(Sinusoidal wave, two tubes unless otherwise specified)

D-C Plate Voltage	1500	2000	2500	volts
D-C Grid Voltage[1]	—65	—95	—125	volts
Zero-Signal D-C Plate Current	65	50	40	ma
Max-Signal D-C Plate Current	515	405	340	ma
Effective Load, Plate-to-Plate	6000	11,000	17,000	ohms
Peak A-F Grid Voltage (per tube)	165	175	195	volts
Max-Signal Peak Driving Power*	25	17	16	watts
Max-Signal Nominal Driving Power*	13	9	8	watts
Max-Signal Plate Input Power	775	810	850	watts
Max-Signal Plate Output Power	500	550	600	watts

*Approximate values.

[1] Adjust to give stated Zero-Signal D-C Plate Current.

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER "TYPICAL OPERATION," POSSIBLY EXCEEDING THE MAXIMUM RATINGS GIVEN FOR CW SERVICE, WRITE EITEL-McCULLOUGH, INC., FOR INFORMATION AND RECOMMENDATIONS.

(Effective 11-25-52) Copyright 1952 by Eitel-McCullough, Inc.

APPLICATION

MECHANICAL

Mounting—The 152TH must be mounted vertically, base down or up. The plate and grid leads should be flexible, and the tube must be protected from vibration and shock.

Cooling—Heat Dissipating Connectors (Eimac HR-5 and HR-6 or equivalent) must be used at the plate and grid terminals of the 152TH. Forced-air cooling is not required in properly designed equipment operating at frequencies below 40 Mc. If the free circulation of air around the tube is restricted, a small fan or centrifugal blower should be used to provide additional cooling.

The temperature of the plate and grid seals must not be allowed to exceed 225° C. One method of measuring these temperatures is by the use of "Tempilaq," a temperature-sensitive lacquer manufactured by the Tempil Corporation, 132-34 West 22nd St., New York 11, N. Y.

ELECTRICAL

Filament Voltage—The filaments of the 152TH may be operated either at 10.0 volts when connected in series or at 5.0 volts when connected in parallel (see basing diagram). For maximum tube life the filament voltage should be maintained at the rated value. Variations must not be allowed to exceed ± 5%.

Bias Voltage—When grid-leak bias is used, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation, and the grid-leak resistor should be made adjustable to facilitate maintaining the bias voltage and plate current at the desired value from tube to tube.

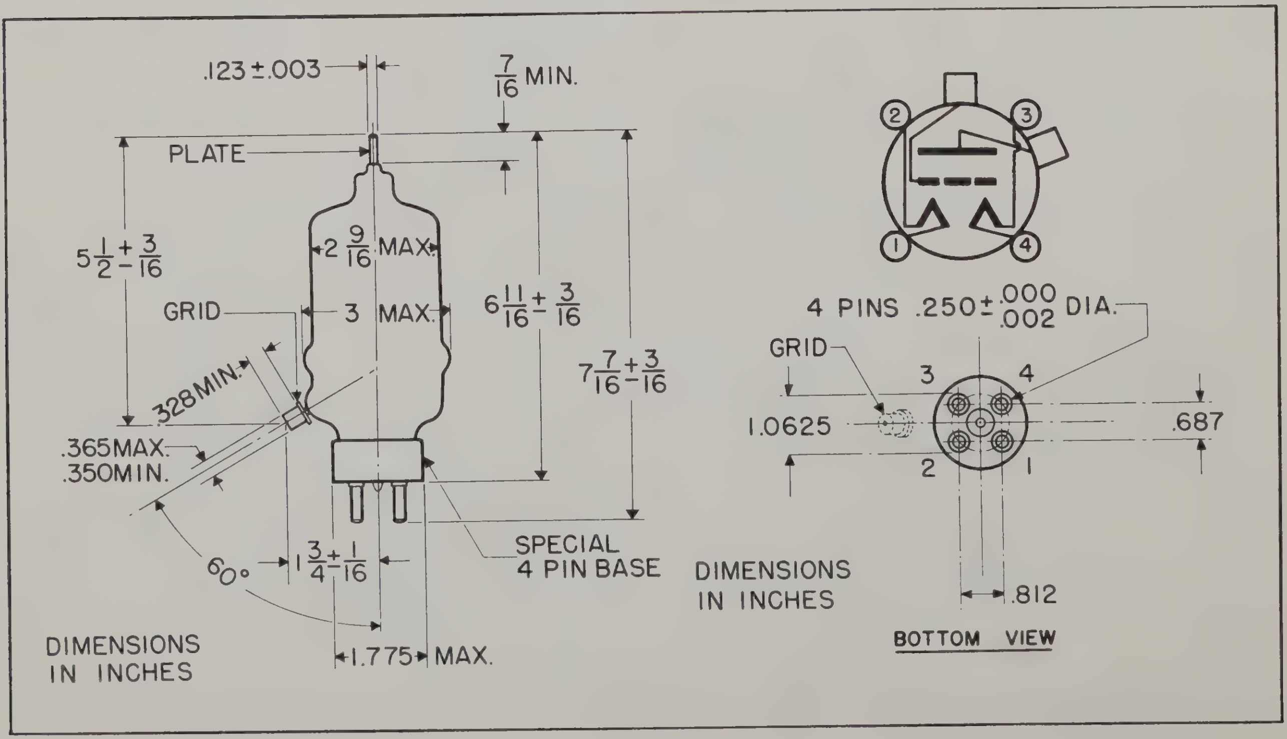
Grid Dissipation—The power dissipated by the grid of the 152TH must not exceed 30 watts. Grid dissipation may be calculated from the following expression.

$$P_g = e_{cmp} I_c$$

where P_g = grid dissipation,
e_{cmp} = peak positive grid voltage, and
I_c = d-c grid current

e_{cmp} may be measured by means of a suitable peak-reading voltmeter connected between filament and grid. In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading.

Plate Dissipation—The plates of the 152TH operate at a visible red color at the maximum rated dissipation of 150 watts. Plate dissipation in excess of the maximum rating is permissible only for short periods of time, such as during tuning procedures.



DRIVING POWER vs. POWER OUTPUT

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The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 1500, 2000 and 3000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 1500, 2000, and 3000 volts respectively.

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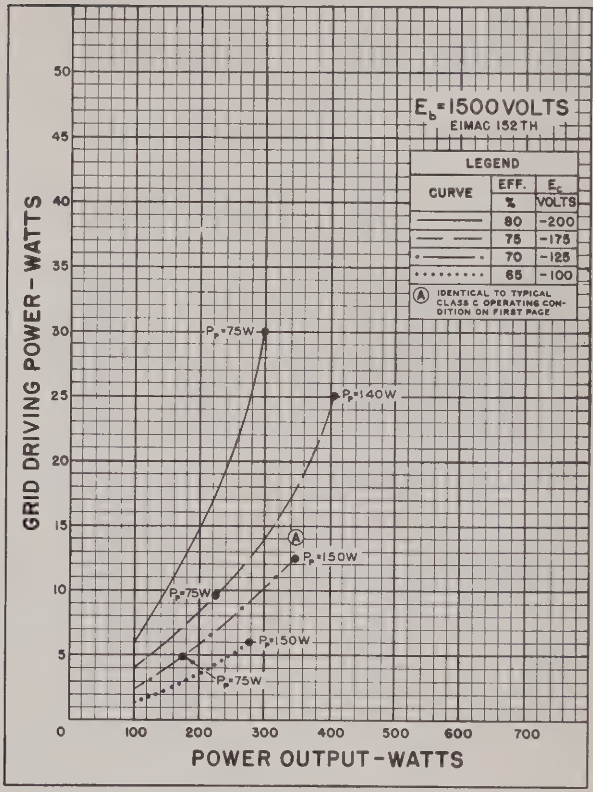
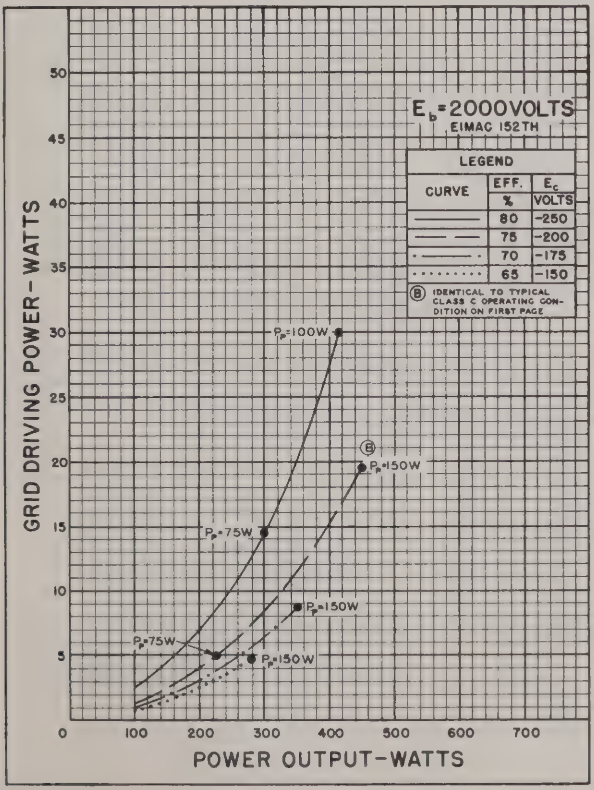
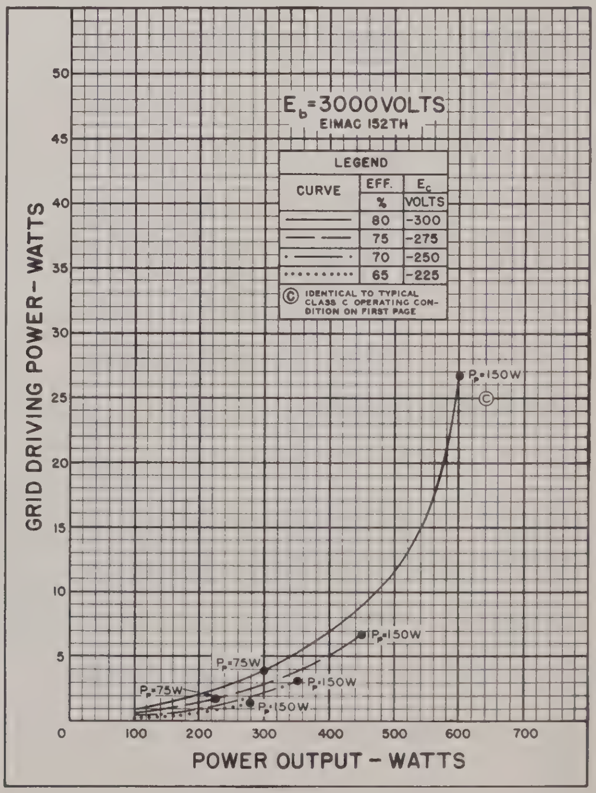
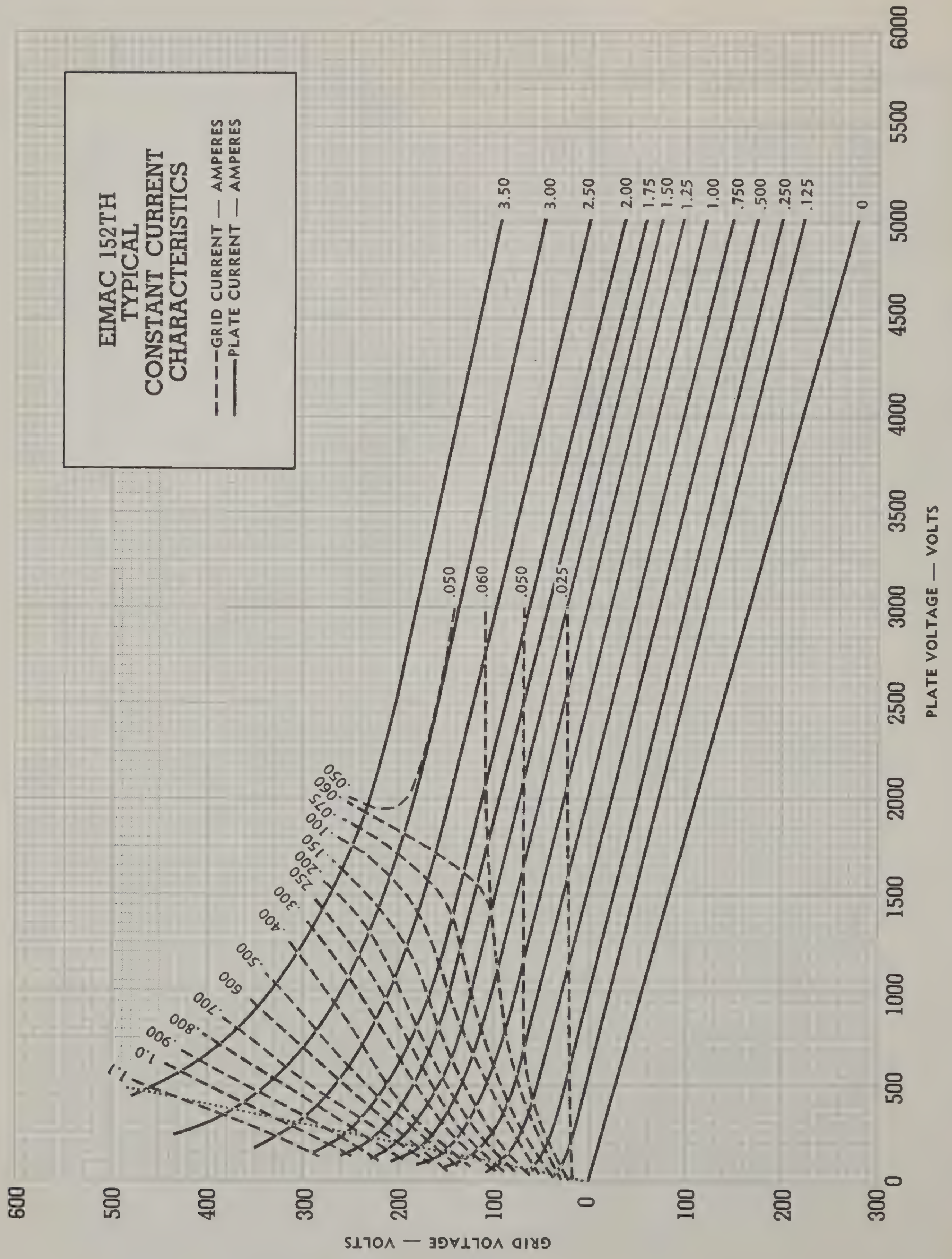







EIMAC 152TH
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
GRID CURRENT — AMPERES
PLATE CURRENT — AMPERES
3.50
3.00
2.50
2.00
1.75
1.50
1.25
1.00
.750
.500
.250
.125
0
.050
.060
.050
.025
.050
.060
.075
.100
.150
.200
.250
.300
.400
.500
.600
.700
.800
.900
1.0
1.1
PLATE VOLTAGE — VOLTS
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
GRID VOLTAGE — VOLTS
600
500
400
300
200
100
0
100
200
300

Eimac®

EITEL-McCULLOUGH, INC.
SAN CARLOS, CALIFORNIA

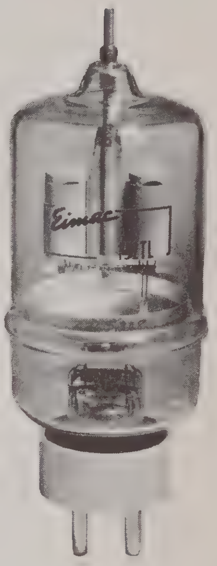
152TL

LOW-MU TRIODE
•
MODULATOR
OSCILLATOR
AMPLIFIER

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated tungsten		
Voltage	5.0 or 10.0	volts
Current	12.5 or 6.25	amperes
Amplification Factor (Average)	12	
Direct Interelectrode Capacitances (Average)		
Grid-Plate	4.4	μμf
Grid-Filament	4.5	μμf
Plate-Filament	0.7	μμf
Transconductance ($i_b = 500$ ma., $E_b = 3000$ v., $E_c = -85$ v.)	7150	umhos



MECHANICAL

Base	Special 4 pin, No. 5000B	
Basing	RMA type 4BC	
Maximum Overall Dimensions:		
Length	7.625	inches
Diameter	2.563	inches
Net weight	7	ounces
Shipping weight (Average)	2.0	pounds

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class B

	ZERO GRID CURRENT OPERATION—2 TUBES			TYPICAL OPERATION 2 TUBES			MAX. RATING	
D-C Plate Voltage	1500	2000	3000	1500	2000	3000	3000	volts
Max.-Sig. D-C Plate Current, per tube*	●	●	●	●	●	●	450	ma.
Plate Dissipation, per tube*	●	●	●	●	●	●	150	watts
D-C Grid Voltage (approx.)	–105	–160	–260	–105	–160	–260		volts
Peak A-F Grid Input Voltage	210	320	520	500	620	675		volts
Zero-Signal D-C Plate Current	135	100	65	135	100	65		ma.
Max.-Signal D-C Plate Current	286	260	220	570	500	335		ma.
Max.-Signal Driving Power (approx.)	0	0	0	15	13	3		watts
Effective Load, Plate-to-Plate	5100	10500	24000	5500	9000	20400		ohms
Max.-Signal Plate Power Output	130	220	370	560	700	700		watts

*Averaged over any sinusoidal audio frequency cycle.

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C *Telegraphy
(Key down conditions without modulation)

	TYPICAL OPERATION—1 TUBE			MAX. RATING	
D-C Plate Voltage	1500	2000	3000	3000	volts
D-C Plate Current	333	300	250	450	ma.
D-C Grid Current	45	42	40	75	ma.
D-C Grid Voltage	–250	–300	–400		volts
Plate Power Output	350	450	600		watts
Plate Input	500	600	750		watts
Plate Dissipation	150	150	150	150	watts
Peak R. F. Grid Input Voltage, (approx.)	400	455	550		volts
Driving Power, (approx.)	16	18	20		watts

*The above figures show actual measured tube performance, and do not allow for variations in circuit losses.

(Effective 1-1-44) Copyright, 1946 by Eitel-McCullough, Inc.

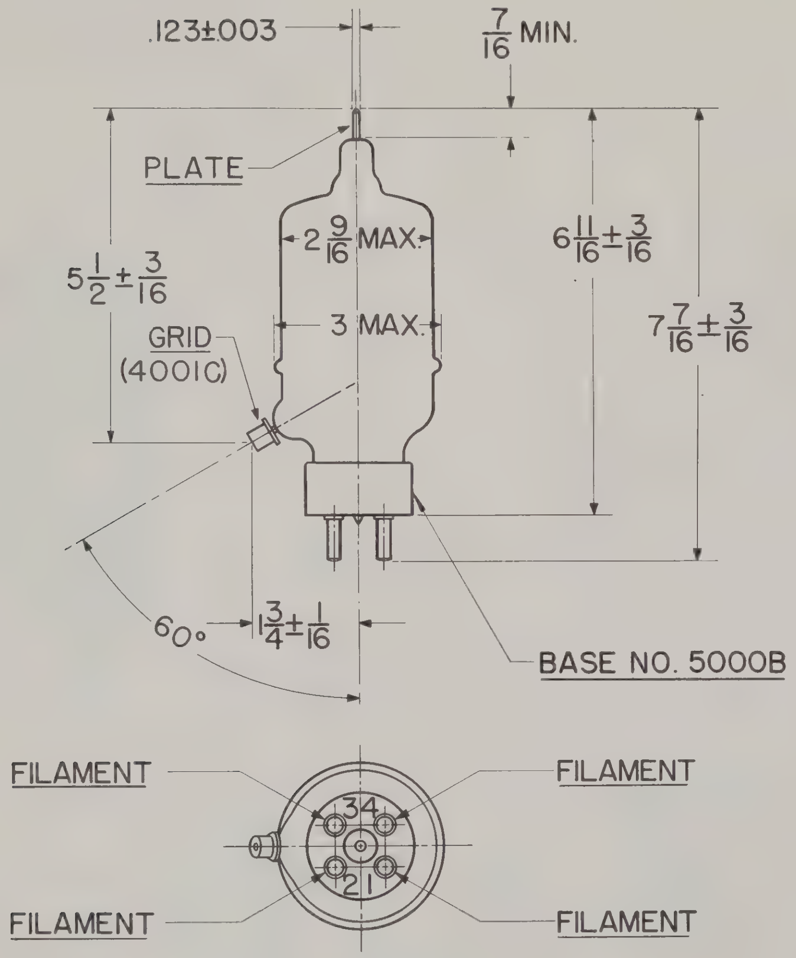
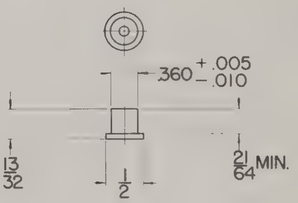


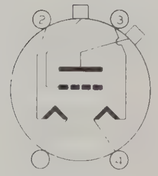
PLATE CAP

(SEE TUBE OUTLINE DRAWING)

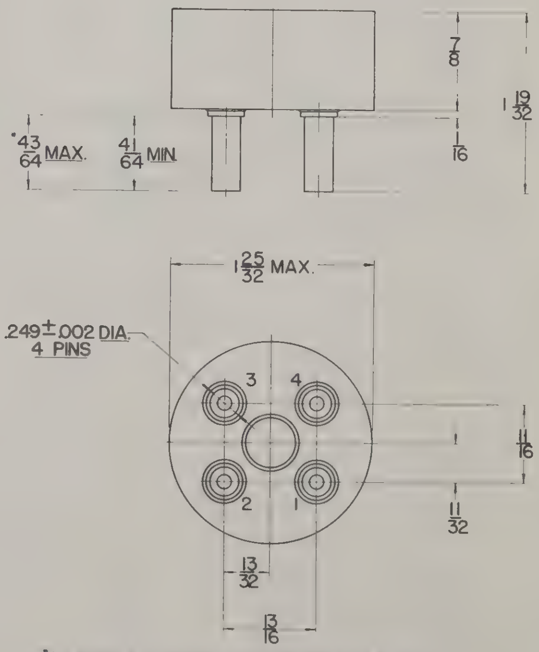
GRID CAP
NO. 4001C



4BC



BASE NO. 5000B



*ON FINISHED TUBE ADD .060 FOR SOLDER

DRIVING POWER vs. POWER OUTPUT

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The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 1500, 2000 and 3000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 1500, 2000, and 3000 volts respectively.

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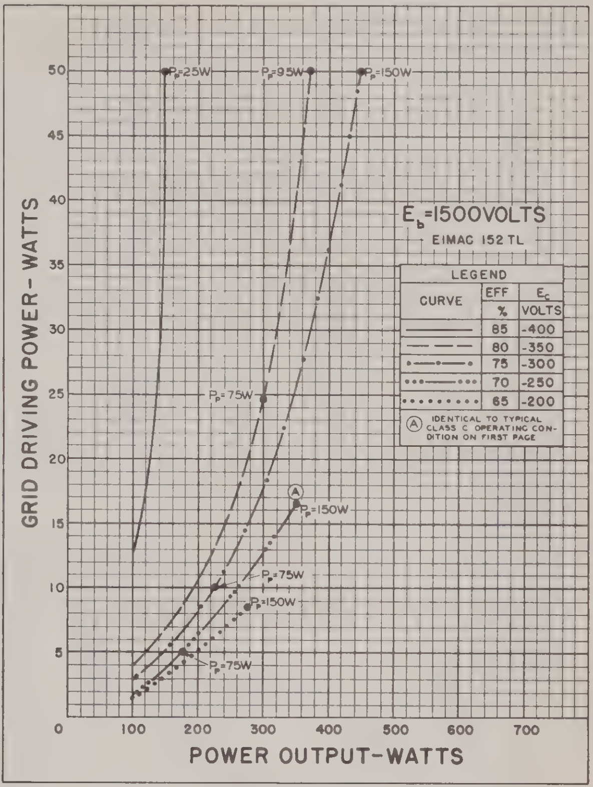
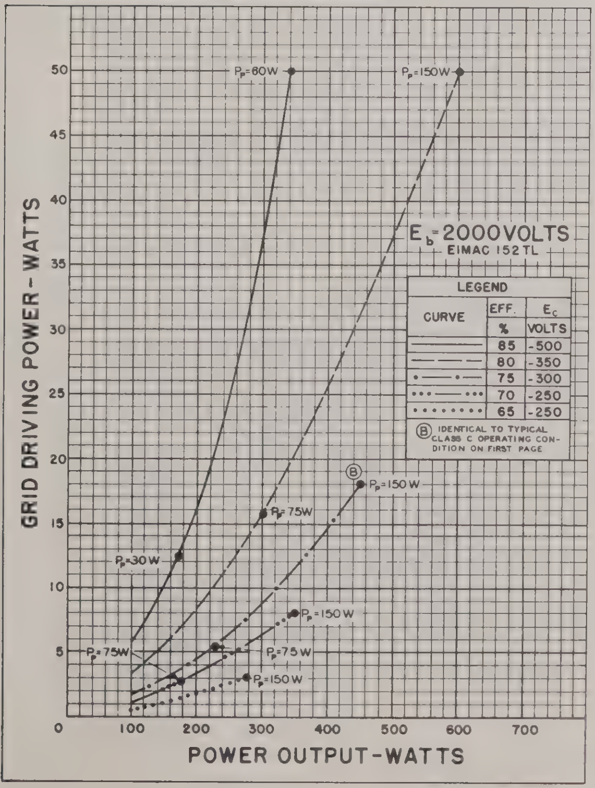
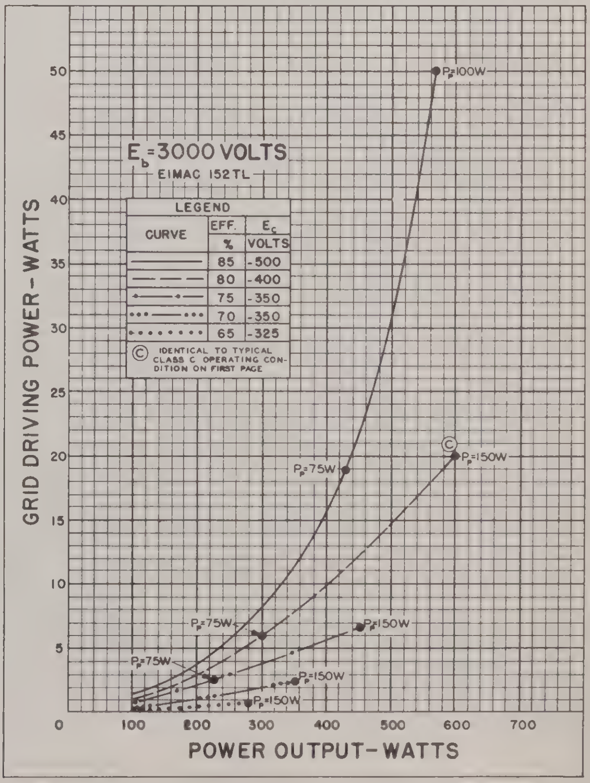
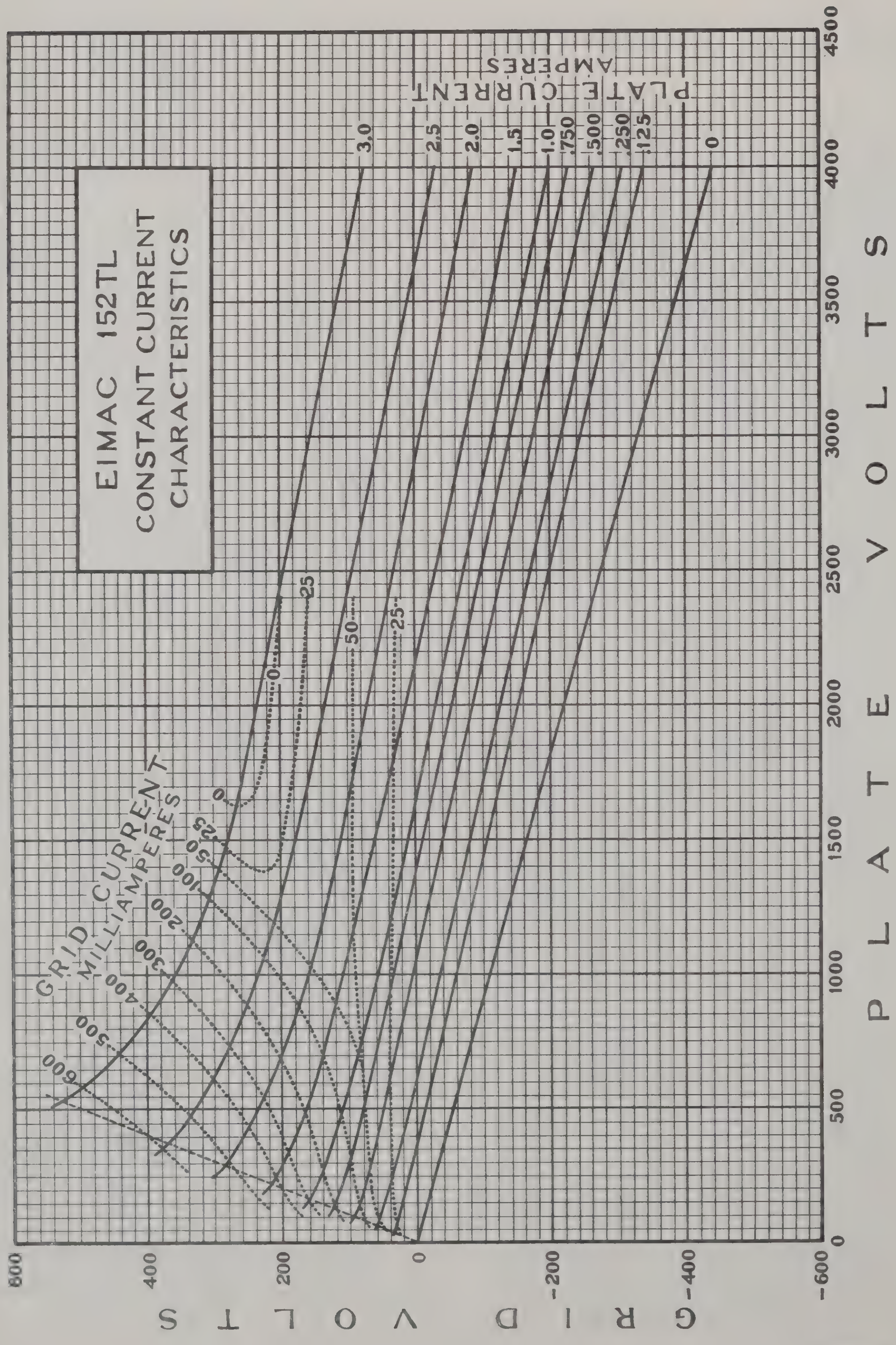







EIMAC 152TL
CONSTANT CURRENT
CHARACTERISTICS
PLATE CURRENT AMPERES
3.0
2.5
2.0
1.5
1.0
.750
.500
.250
.125
0
GRID CURRENT MILLIAMPERES
600
500
400
300
200
100
50
25
0
25
0
50
25
PLATE VOLTS
0
500
1000
1500
2000
2500
3000
3500
4000
4500
GRID VOLTS
600
400
200
0
-200
-400
-600

Eimac®

EITEL-McCULLOUGH, INC.
[illegible]

250TH

HIGH-MU TRIODE

MODULATOR
OSCILLATOR
AMPLIFIER

The Eimac 250TH is a high-mu power triode intended for use as an amplifier, oscillator or modulator. It has a maximum plate-dissipation rating of 250 watts and a maximum plate-voltage rating of 4000 volts at frequencies up to 40 Mc.

The 250TH in class-C r-f service will deliver up to 1000 watts plate power output with 39 watts driving power. Two 250TH's in class-AB_2 modulator service will deliver up to 1180 watts maximum-signal plate power output with 42 watts nominal driving power.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten	
Voltage	5.0 volts
Current	10.5 amperes
Amplification Factor (Average)	37
Direct Interelectrode Capacitances (Average)	
Grid-Plate	2.9 μμf
Grid-Filament	4.6 μμf
Plate-Filament	0.5 μμf
Transconductance (I_b=300 ma., E_b=3000 v.)	5600 μmhos
Highest Frequency for Maximum Ratings	40 Mc

MECHANICAL

Base	Special 4-pin
Basing	See outline drawing
Socket	National No. XM-50 E. F. Johnson No. 123-211 or equivalent
Mounting Position	Vertical, base down or up
Cooling	Convection and radiation
Maximum Temperature of Plate and Grid Seals	225°C
Recommended Heat-Dissipating Connectors:	
Plate	Eimac HR-6
Grid	Eimac HR-3
Maximum Over-all Dimensions:	
Length	10.13 inches
Diameter	3.81 inches
Net Weight	10 ounces
Shipping Weight	3 pounds

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony
(Key-down conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	4000 MAX. VOLTS
D-C PLATE CURRENT	350 MAX. MA
PLATE DISSIPATION	250 MAX. WATTS
GRID DISSIPATION	40 MAX. WATTS

TYPICAL OPERATION, per tube (Frequencies up to 40 Mc.)

D-C Plate Voltage	2000	3000	4000	volts
D-C Grid Voltage	—100	—150	—220	volts
D-C Plate Current	357	333	313	ma
D-C Grid Current*	94	90	93	ma
Peak R-F Grid Voltage (approx.)	345	395	470	volts
Driving Power*	29	32	39	watts
Grid Dissipation	20	19	18	watts
Plate Power Input	714	1000	1250	watts
Plate Dissipation	250	250	250	watts
Plate Power Output	464	750	1000	watts

PLATE MODULATED RADIO FREQUENCY POWER AMPLIFIER

Class-C Telephony (Carrier conditions)

MAXIMUM RATINGS, PER TUBE (Frequencies up to 40 Mc.)

D-C PLATE VOLTAGE	3200 MAX. VOLTS
D-C PLATE CURRENT	280 MAX. MA
PLATE DISSIPATION	165 MAX. WATTS
GRID DISSIPATION	40 MAX. WATTS

TYPICAL OPERATION, per tube[1] (Frequencies up to 40 Mc.)

D-C Plate Voltage	2000	2500	3000	volts
D-C Grid Voltage	—160	—180	—200	volts
D-C Plate Current	250	225	200	ma
D-C Grid Current*	60	45	38	ma
Peak R-F Grid Voltage	365	365	375	volts
Driving Power*	22	17	14	watts
Grid Dissipation*	12	8	6	watts
Plate Power Input	500	565	600	watts
Plate Dissipation	165	165	165	watts
Plate Power Output	335	400	435	watts

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class-AB_2 (Sinusoidal wave, two tubes unless otherwise specified)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	4000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT, PER TUBE	350 MAX. MA
MAX-SIGNAL PLATE DISSIPATION, PER TUBE	250 MAX. WATTS
MAX-SIGNAL GRID DISSIPATION	40 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	1500	2000	3000	volts
D-C Grid Voltage[1]	0	—30	—65	volts
Zero-Signal D-C Plate Current	220	140	100	ma
Max-Signal D-C Plate Current	700	700	560	ma
Effective Load, Plate-to-Plate	4200	6000	12,200	ohms
Peak A-F Grid Voltage (per tube)	230	260	260	volts
Max-Signal Peak Driving Power*	92	104	83	watts
Max-Signal Nominal Driving Power*	46	52	42	watts
Max Signal Plate Power Input	1050	1400	1680	watts
Max-Signal Plate Power Output	630	900	1180	watts

*Approximate values.

[1] Adjust to give stated Zero-Signal D-C Plate Current.

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER "TYPICAL OPERATION", POSSIBLY EXCEEDING THE MAXIMUM RATINGS GIVEN FOR CW SERVICE, WRITE EITEL-McCULLOUGH, INC., FOR INFORMATION AND RECOMMENDATIONS.

APPLICATION

MECHANICAL

Mounting—The 250TH must be mounted vertically, base down or up. The plate and grid leads should be flexible, and the tube must be protected from vibration and shock.

Cooling—Heat Dissipating Connectors (Eimac HR-6 and HR-3 or equivalent) must be used at the plate and grid terminals of the 250TH. Forced-air cooling is not required in properly designed equipment operating at frequencies below 40 Mc. If the free circulation of air around the tube is restricted, a small fan or centrifugal blower should be used to provide additional cooling.

The temperature of the plate and grid seals must not be allowed to exceed 225° C. One method of measuring these temperatures is by the use of "Tempilaq," a temperature-sensitive lacquer manufactured by the Tempil Corporation, 132 W. 22nd St., New York 11, N. Y.

ELECTRICAL

Filament Voltage—The filament voltage, as measured directly at the tube, should be 5.0 volts with maximum allowable variations due to line fluctuations from 5.25 to 4.75 volts.

Bias Voltage—When grid-leak bias is used, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation, and the grid-leak resistor should be made adjustable to facilitate maintaining the bias voltage and plate current at the desired value from tube to tube.

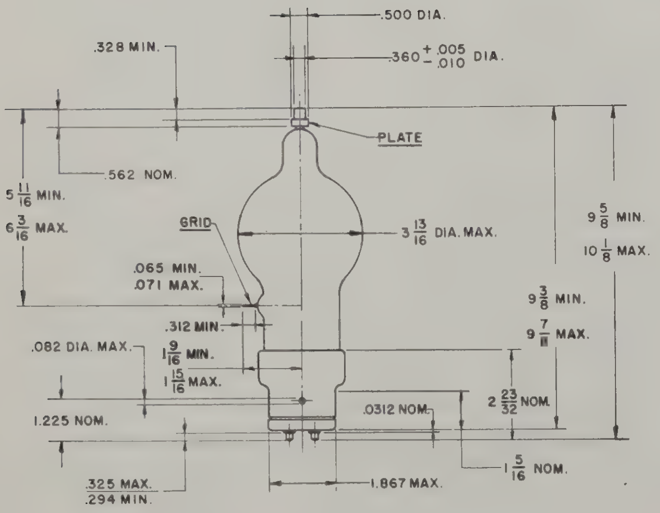
Grid Dissipation—The power dissipated by the grid of the 250TH must not exceed 40 watts. Grid dissipation may be calculated from the following expression.

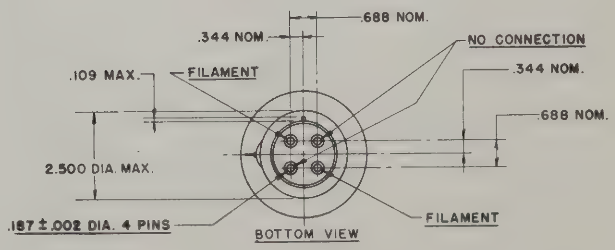
$$P_g = e_{cmp} I_c$$

where P_g = grid dissipation,
e_{cmp} = peak positive grid voltage, and
I_c = d-c grid current.

e_{cmp} may be measured by means of a suitable peak-reading voltmeter connected between filament and grid. In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading.

Plate Dissipation—The plates of the 250TH operate at a visibly red color at the maximum rated dissipation of 250 watts. Plate dissipation in excess of the maximum rating is permissible only for short periods of time, such as during tuning procedures.





DIMENSIONS IN INCHES

DRIVING POWER vs. POWER OUTPUT

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The three charts on this page show the relationship of plate efficiency, power output and approximate grid driving power at plate voltages of 2000, 3000, and 4000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 2000, 3000, and 4000 volts respectively.

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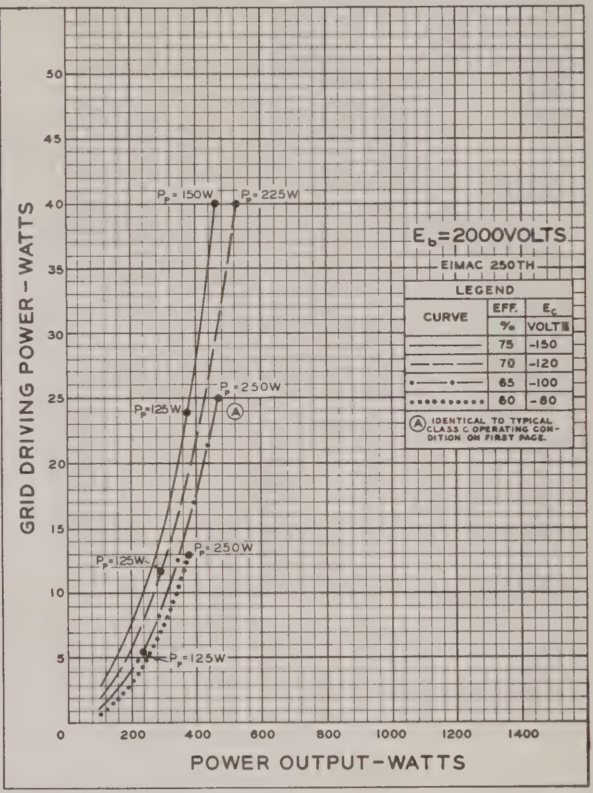

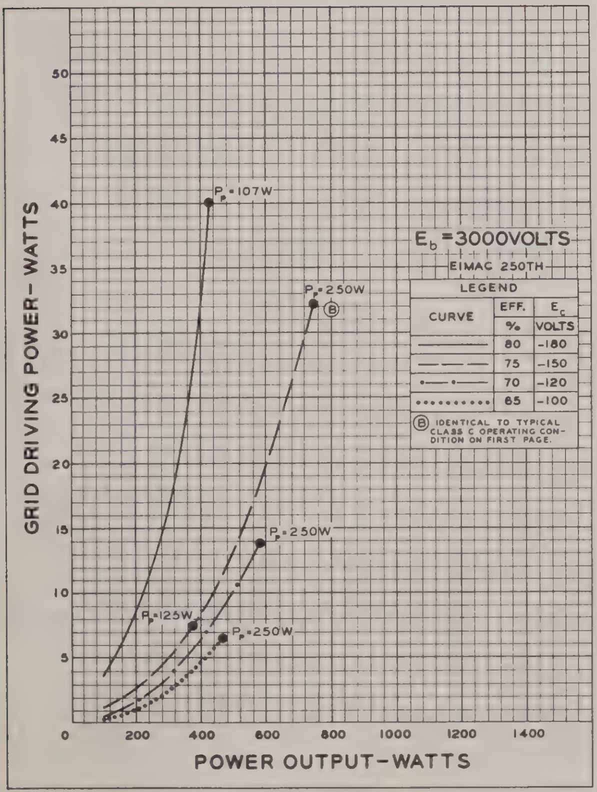

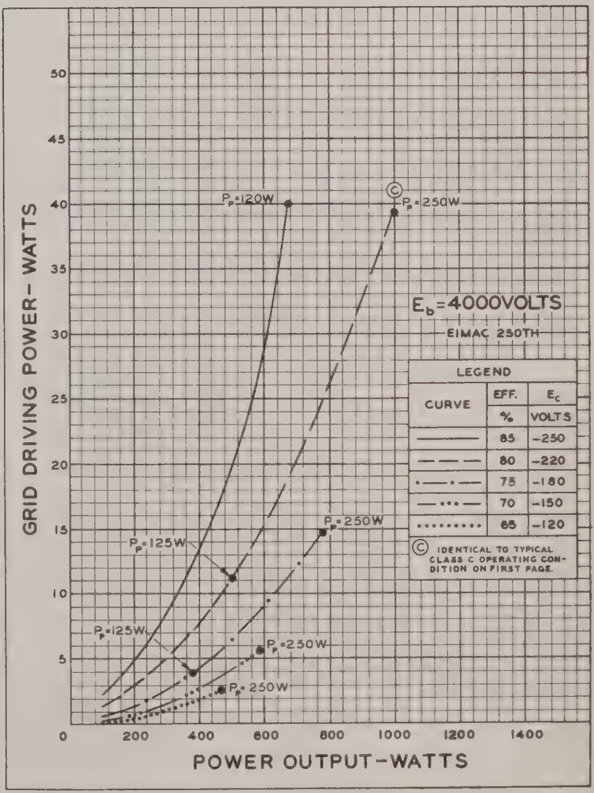

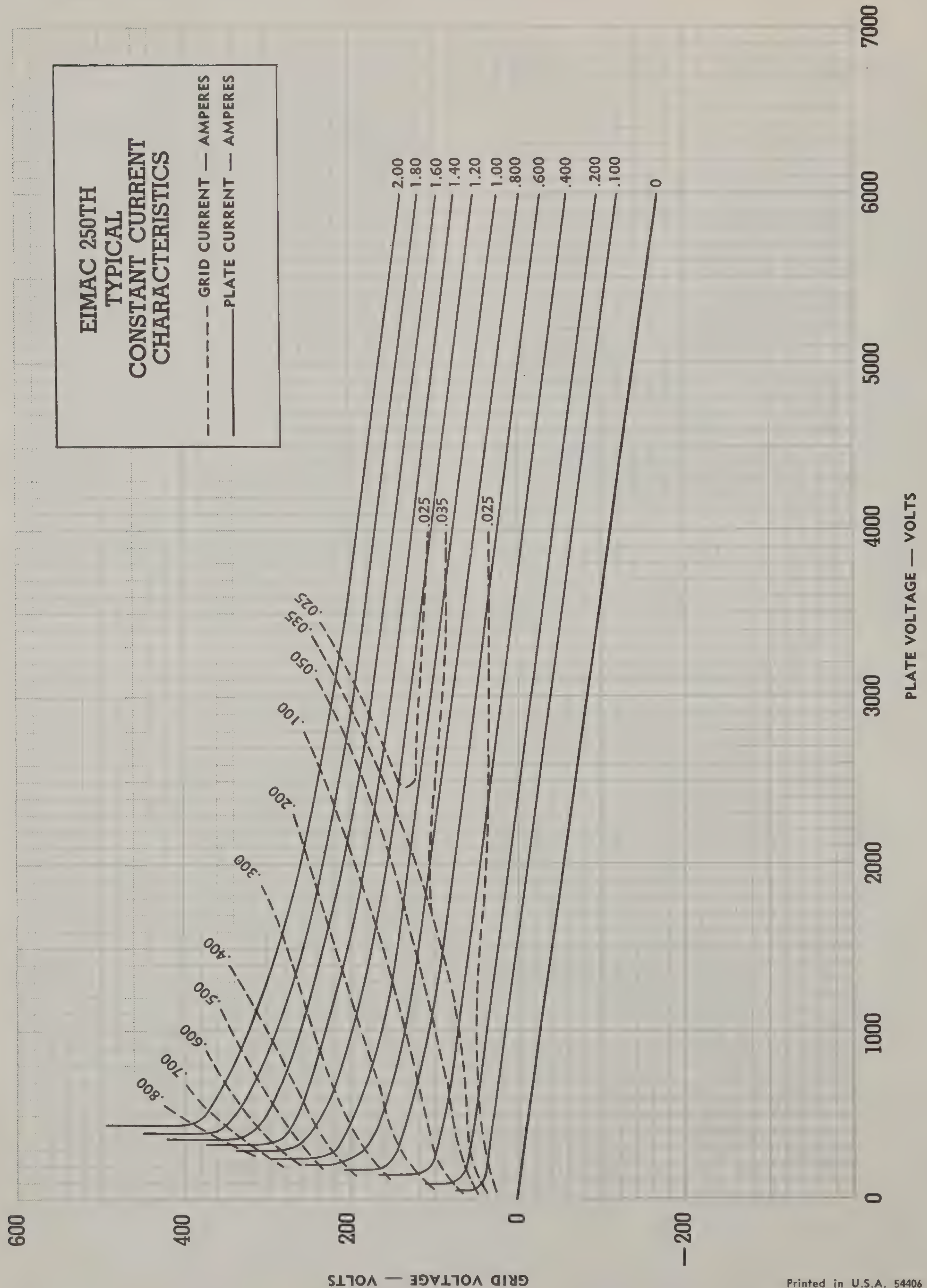

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EITEL-McCULLOUGH, INC.

250TL

LOW-MU TRIODE

MODULATOR
OSCILLATOR
AMPLIFIER

The Eimac 250TL is a low-mu triode having a maximum plate dissipation of 250 watts. It is intended for use as an amplifier, oscillator or modulator, and can be used at its maximum ratings at frequencies up to 40 Mc.

Cooling of the 250TL is accomplished by radiation from the plate, which operates at a visible red color at maximum dissipation, and by means of air circulation around the envelope.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated tungsten

Voltage	5.0 volts
Current	10.5 amperes
Amplification Factor (Average)	14

Direct Interelectrode Capacitances (Average)

Grid-Plate	3.0 μμf
Grid-Filament	3.7 μμf
Plate-Filament	0.7 μμf
Transconductance (I_b=350 ma., E_b=3000V.)	2650 μmhos
Frequency for Maximum Ratings	40 Mc

MECHANICAL

Base: Medium 4-pin bayonet type, fits E. F. Johnson No. 211 series sockets, National XM-50 socket, or the equivalent.
For pin connections, see outline drawing.

Mounting	Vertical, base down or up.
Cooling	Convection and radiation.

Recommended Heat Dissipating Connectors:

Plate	Eimac HR-6
Grid	Eimac HR-3

Maximum Over-all Dimensions:

Length	10.13 inches
Diameter	3.81 inches
Net Weight	10 ounces
Shipping Weight	3 pounds

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class-AB$_2$ (Sinusoidal wave, two tubes unless otherwise specified)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	4000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT, PER TUBE	350 MAX. MA.
MAX-SIGNAL PLATE DISSIPATION, PER TUBE	250 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	1500	2000	3000	Volts
D-C Grid Voltage (approx.)*	—40	—90	—170	Volts
Zero-Signal D-C Plate Current	200	150	100	Ma.
Max-Signal D-C Plate Current	700	650	500	Ma.
Effective Load, Plate-to-Plate	3800	6150	13,000	Ohms
Peak A-F Grid Input Voltage (per tube)	390	410	400	Volts
Max-Signal Peak Driving Power	76	74	32	Watts
Max-Signal Nominal Driving Power	38	37	16	Watts
Max-Signal Plate Power Output	580	800	1000	Watts

*Adjust for given zero-signal plate current.

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony
(Key-down conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	4000 MAX. VOLTS
D-C PLATE CURRENT	350 MAX. MA.
PLATE DISSIPATION	250 MAX. WATTS
GRID DISSIPATION	35 MAX. WATTS

TYPICAL OPERATION, per tube* (Frequencies up to 40 Mc.)

D-C Plate Voltage	2000	3000	4000	Volts
D-C Grid Voltage	—200	—350	—500	Volts
D-C Plate Current	350	335	310	Ma.
D-C Grid Current	45	45	40	Ma.
Peak R-F Grid Input Voltage (approx.)	575	720	900	Volts
Driving Power (approx.)	22	29	33	Watts
Grid Dissipation (approx.)	14	15	14	Watts
Power Input	700	1000	1250	Watts
Plate Dissipation	245	250	250	Watts
Plate Power Output	455	750	1000	Watts

*These figures show actual measured tube performance and do not allow for variations in circuit losses.

PLATE MODULATED RADIO FREQUENCY POWER AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	3200 MAX. VOLTS
D-C PLATE CURRENT	280 MAX. MA.
PLATE DISSIPATION	165 MAX. WATTS
GRID DISSIPATION	35 MAX. WATTS

TYPICAL OPERATION, per tube* (Frequencies up to 40 Mc.)

D-C Plate Voltage	2000	2500	3000	Volts
D-C Plate Current	250	225	200	Ma.
Total D-C Bias Voltage	—520	—520	—520	Volts
Grid Resistor	13,000	15,000	17,500	Ohms
Fixed D-C Bias Supply Voltage	—140	—220	—266	Volts
D-C Grid Current	29	20	14	Ma.
Peak R-F Grid Input Voltage	840	795	795	Volts
Driving Power (approx.)	24	16	11	Watts
Grid Dissipation (approx.)	9	6	5	Watts
Plate Power Input	500	565	600	Watts
Plate Dissipation	165	165	165	Watts
Plate Power Output	335	400	435	Watts

*These figures show actual measured tube performance and do not allow for variations in circuit losses.

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER "TYPICAL OPERATION", POSSIBLY EXCEEDING THE MAXIMUM RATINGS GIVEN FOR CW SERVICE, WRITE EITEL-McCULLOUGH, INC. FOR INFORMATION AND RECOMMENDATIONS.

APPLICATION

MECHANICAL

Mounting—The 250TL must be mounted vertically, base down or up. The plate and grid leads should be flexible, and the tube must be protected from vibration and shock.

Cooling—Heat Dissipating Connectors (Eimac HR-6 and HR-3 or equivalent) must be used at the plate and grid terminals of the 250TL. Forced-air cooling is not required in properly designed equipment operating at frequencies below 40 Mc. If the free circulation of air around the tube is restricted, a small fan or centrifugal blower should be used to provide additional cooling.

The temperature of the plate and grid seals must not be allowed to exceed 225° C. One method of measuring these temperatures is by the use of "Tempilaq," a temperature-sensitive lacquer manufactured by the Tempil Corporation, 11 W. 25th St., New York 10, N. Y.

ELECTRICAL

Filament Voltage—The filament voltage, as measured directly at the tube, should be 5.0 volts with maximum allowable variations due to line fluctuations from 5.25 to 4.75 volts.

Bias Voltage—When grid-leak bias is used, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation, and the grid-leak resistor should be made adjustable to facilitate maintaining the bias voltage and plate current at the desired value from tube to tube.

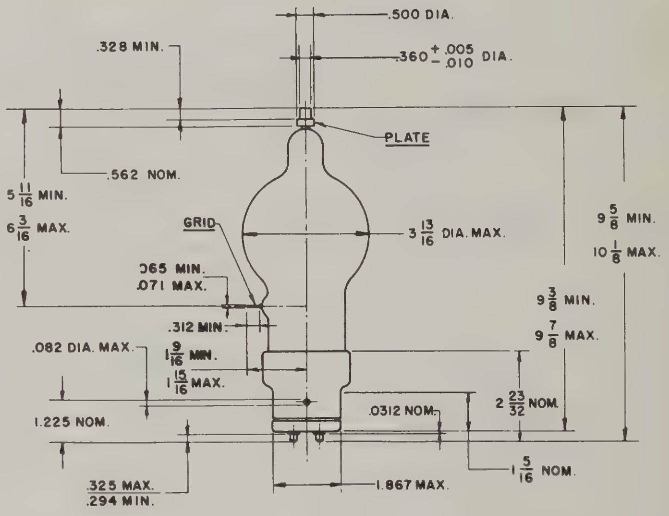
Grid Dissipation—The power dissipated by the grid of the 250TL must not exceed 40 watts. Grid dissipation may be calculated from the following expression.

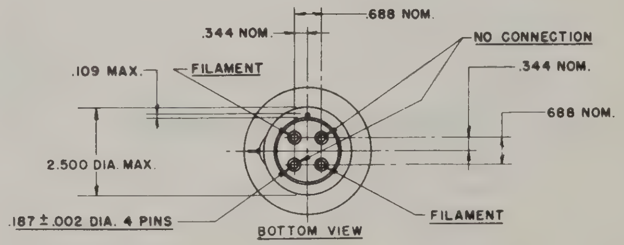
$$P_g = e_{cmp} I_c$$

where P_g = grid dissipation,
e_{cmp} = peak positive grid voltage, and
I_c = d-c grid current

e_{cmp} may be measured by means of a suitable peak-reading voltmeter connected between filament and grid.[1] In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading.

Plate Dissipation—The plates of the 250TL operate at a visibly red color at the maximum rated dissipation of 250 watts. Plate dissipation in excess of the maximum rating is permissible only for short periods of time, such as during tuning procedures.





DIMENSIONS IN INCHES

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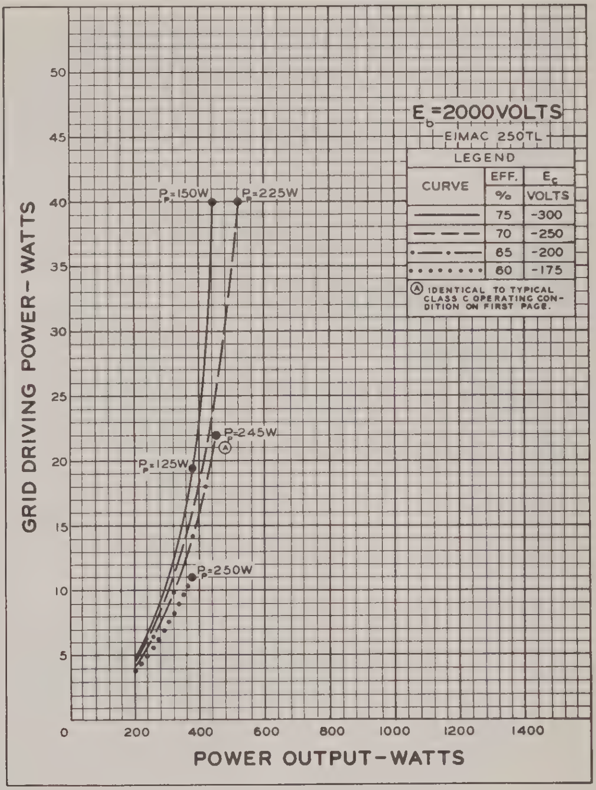
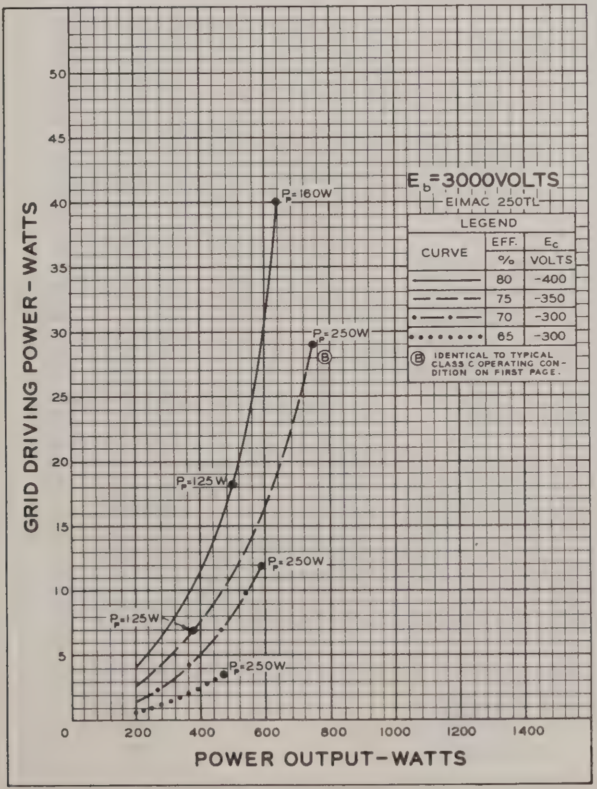
[1] For suitable peak v.t.v.m. circuits see, for instance, "Vacuum Tube Ratings," **Eimac News**, January, 1945. This article is available in reprint form on request.

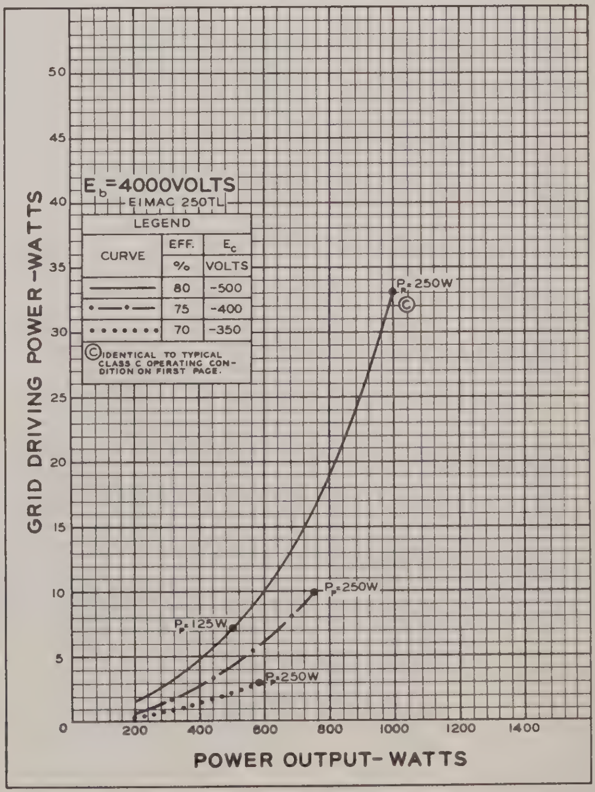
DRIVING POWER vs. POWER OUTPUT

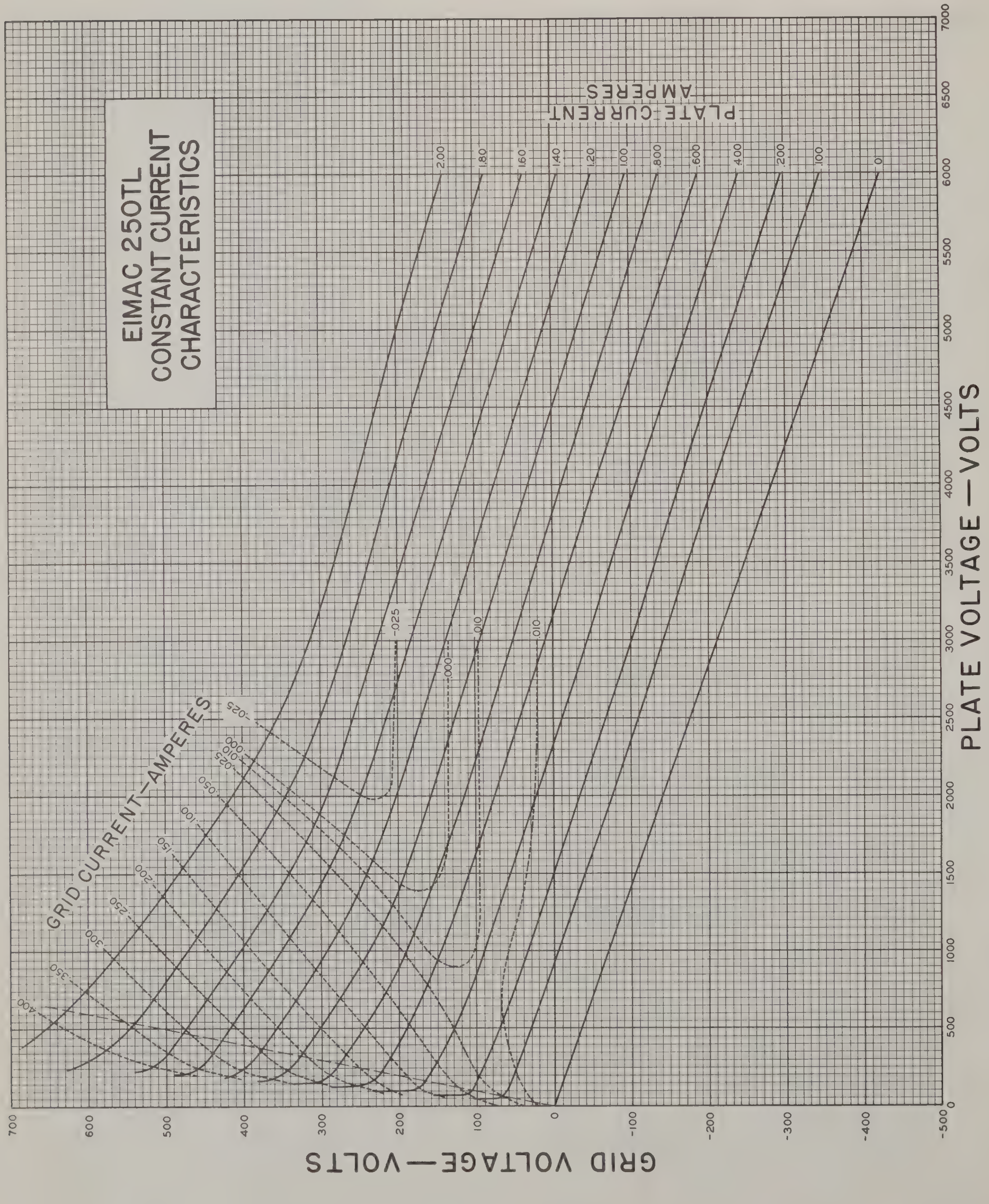
The three charts on this page show the relationship of plate efficiency, power output and approximate grid driving power at plate voltages of 2000, 3000 and 4000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by Pp.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 2000, 3000, and 4000 volts respectively.









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304TH

MEDIUM-MU TRIOD

MODULATOR
OSCILLATOR
AMPLIFIER

The Eimac 304TH is a medium-mu power triode intended for use as an amplifier, oscillator or modulator. It has a maximum plate-dissipation rating of 300 watts and a maximum plate-voltage rating of 3000 volts at frequencies up to 40 Mc.

The 304TH in class-C r-f service will deliver up to 1200 watts plate power output with 53 watts driving power. Two 304TH's in class-AB_2 modulator service will deliver up to 1400 watts maximum-signal plate power output with 14 watts nominal driving power.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten	
Voltage	5.0 or 10.0 volts
Current	25.0 or 12.5 amperes
Amplification Factor (Average)	20
Direct Interelectrode Capacitances (Average)	
Grid-Plate	10.2 μμf
Grid-Filament	13.5 μμf
Plate-Filament	0.7 μμf
Transconductance (I_b = 1.0 amp., E_b = 3000 v.)	16,700 μmhos
Highest Frequency for Maximum Ratings	40 Mc

MECHANICAL

Base	Special 4-pin
Basing	See outline drawing
Socket	Johnson type No. 124-213 or equivalent
Mounting Position	Vertical, base down or up
Cooling	Convection and radiation
Maximum Temperature of Plate and Grid Seals	225° C
Recommended Heat-Dissipating Connectors:	
Plate	Eimac HR-7
Grid	Eimac HR-6
Maximum Over-all Dimensions:	
Length	7.63 inches
Diameter	3.56 inches
Net Weight	9 ounces
Shipping Weight	3.0 pounds

RADIO-FREQUENCY POWER AMPLIFIER OR OSCILLATOR

Class-C Telegraphy (Key-down conditions, one tube)

MAXIMUM RATINGS (Frequencies up to 40 Mc.)

D-C PLATE VOLTAGE	3000 MAX. VOLTS
D-C PLATE CURRENT	900 MAX. MA
PLATE DISSIPATION	300 MAX. WATTS
GRID DISSIPATION	60 MAX. WATTS

TYPICAL OPERATION (Frequencies up to 40 Mc.)

D-C Plate Voltage	1500	2000	3000 volts
D-C Grid Voltage	—125	—200	—300 volts
D-C Plate Current	665	600	500 ma
D-C Grid Current*	115	125	135 ma
Peak R-F Grid Voltage	250	325	395 volts
Driving Power*	25	39	53 watts
Grid Dissipation*	16	12	16 watts
Plate Dissipation	300	300	300 watts
Plate Power Input	1000	1200	1500 watts
Plate Power Output	700	900	1200 watts

PLATE-MODULATED RADIO-FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS (Frequencies up to 40 Mc.)

D-C PLATE VOLTAGE	2500 MAX. VOLTS
D-C PLATE CURRENT	750 MAX. MA
PLATE DISSIPATION	200 MAX. WATTS
GRID DISSIPATION	60 MAX. WATTS

TYPICAL OPERATION (Frequencies up to 40 Mc.)

D-C Plate Voltage	1500	2000	2500 volts
D-C Grid Voltage	—200	—300	—350 volts
D-C Plate Current	420	440	400 ma
D-C Grid Current*	55	60	60 ma
Peak R-F Grid Voltage	330	440	485 volts
Driving Power*	18	26	29 watts
Grid Dissipation*	7	8	8 watts
Plate Dissipation	200	200	200 watts
Plate Power Input	700	880	1000 watts
Plate Power Output	500	680	800 watts

AUDIO-FREQUENCY POWER AMPLIFIER OR MODULATOR

Class-AB_2

MAXIMUM RATINGS (Per tube)

D-C PLATE VOLTAGE	3000 MAX. VOLTS
D-C PLATE CURRENT	900 MAX. MA
PLATE DISSIPATION	300 MAX. WATTS

TYPICAL OPERATION (Sinusoidal wave, two tubes unless otherwise specified.)

D-C Plate Voltage	1500	2000	3000 volts
D-C Grid Voltage[1]	—65	—90	—150 volts
Zero Signal D-C Plate Current	265	200	135 ma
Max. Signal D-C Plate Current	1065	900	665 ma
Effective Load Plate-to-Plate	2840	4820	10,200 ohms
Peak A-F Grid Voltage (per tube)	165	175	210 volts
Max. Signal Peak Driving Power*	50	37	27 watts
Max. Signal Nominal Driving Power*	25	19	14 watts
Max. Signal Plate Power Input	1600	1800	2000 watts
Max. Signal Plate Power Output	1000	1200	1400 watts

*Approximate values.

[1] Adjust to give stated Zero-Signal D-C Plate Current.

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER "TYPICAL OPERATION," POSSIBLY EXCEEDING THE MAXIMUM RATINGS GIVEN FOR CW SERVICE, WRITE EITEL-McCULLOUGH, INC., FOR INFORMATION AND RECOMMENDATIONS.

MECHANICAL

Mounting—The 304TH must be mounted vertically, base down or up. The plate and grid leads should be flexible, and the tube must be protected from vibration and shock.

Cooling—Heat Dissipating Connectors (Eimac HR-7 and HR-6 or equivalent) must be used at the plate and grid terminals of the 304TH. Forced-air cooling is not required in properly designed equipment operating at frequencies below 40 Mc. If the free circulation of air around the tube is restricted, a small fan or centrifugal blower should be used to provide additional cooling.

The temperature of the plate and grid seals must not be allowed to exceed 225° C. One method of measuring these temperatures is by the use of "Tempilaq," a temperature-sensitive lacquer manufactured by the Tempil Corporation, 132 W. 22nd St., New York 11, N. Y.

ELECTRICAL

Filament Voltage—The filaments of the 304TH may be operated either at 10.0 volts when connected in series or at 5.0 volts when connected in parallel (see basing diagram). For maximum tube life the filament voltage should be maintained at the rated value. Variations must not be allowed to exceed ± 5%.

Bias Voltage—When grid-leak bias is used, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation, and the grid-leak resistor should be made adjustable to facilitate maintaining the bias voltage and plate current at the desired value from tube to tube.

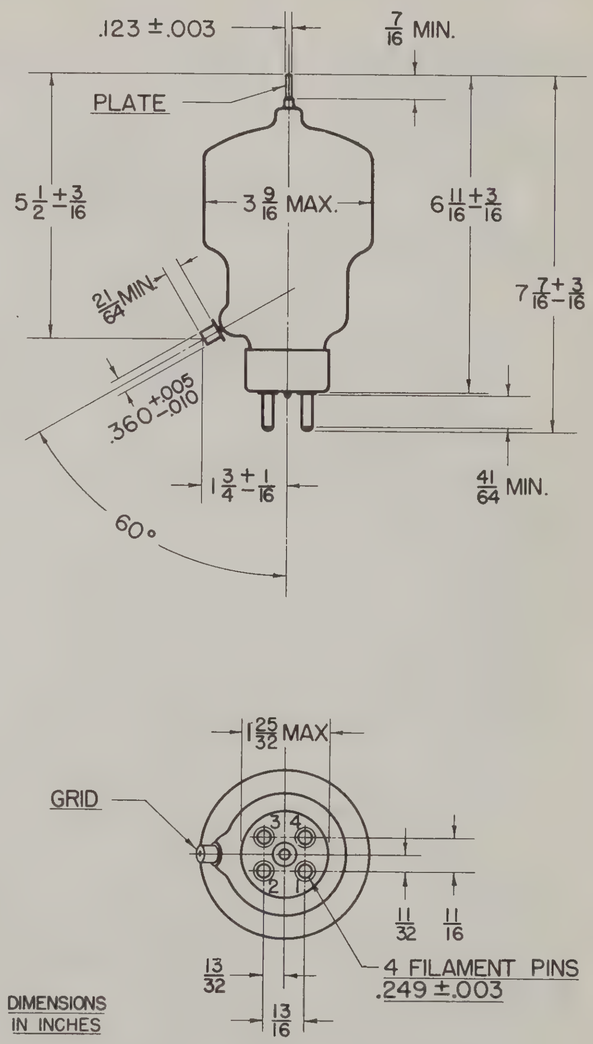
Grid Dissipation—The power dissipated by the grid of the 304TH must not exceed 60 watts. Grid dissipation may be calculated from the following expression.

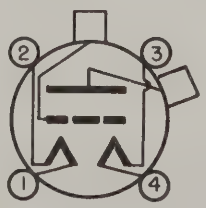
$$P_g = e_{cmp} I_c$$

where P_g = grid dissipation,
e_{cmp} = peak positive grid voltage, and
I_c = d-c grid current.

e_{cmp} may be measured by means of a suitable peak-reading voltmeter connected between filament and grid. In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading.

Plate Dissipation—The plates of the 304TH operate at a visible red color at the maximum rated dissipation of 300 watts. Plate dissipation in excess of the maximum rating is permissible only for short periods of time, such as during tuning procedures.





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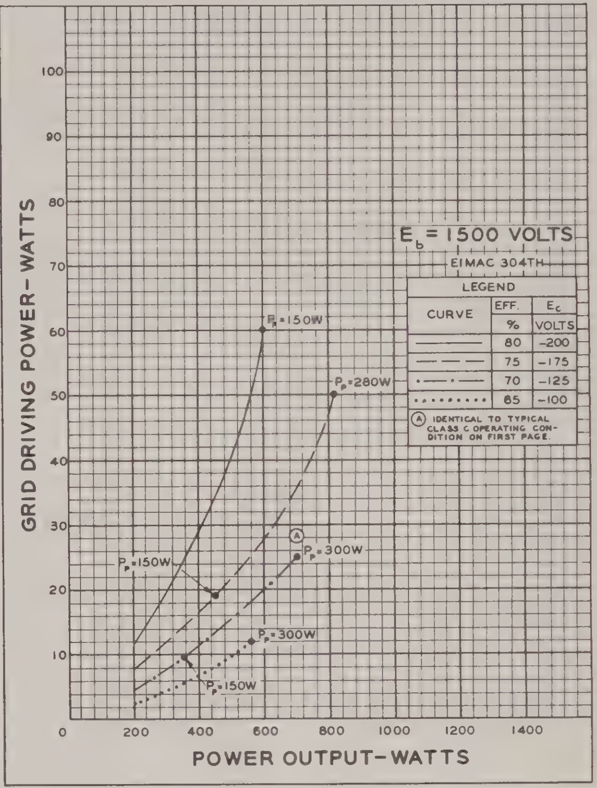
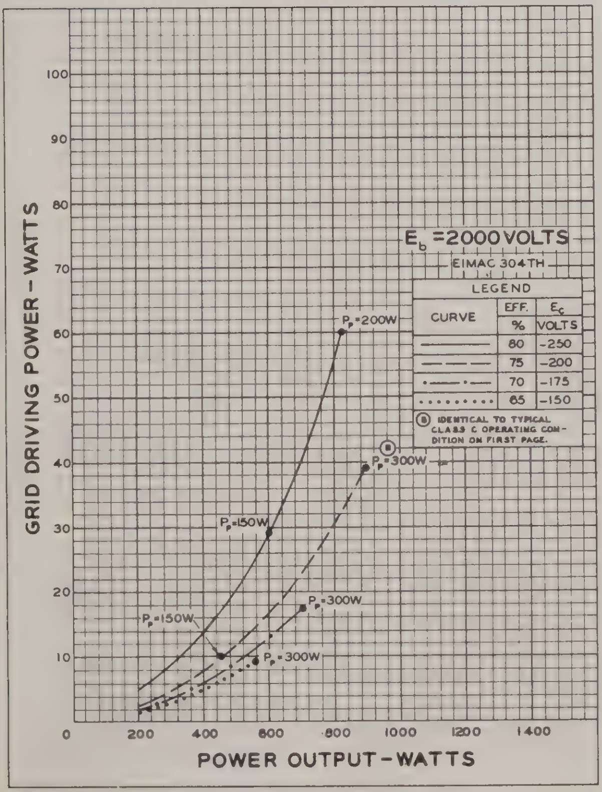
[1] For suitable peak v.t.v.m. circuits see, for instance, "Vacuum Tube Ratings," **Eimac News,** January, 1945. This article is available in reprint form on request.

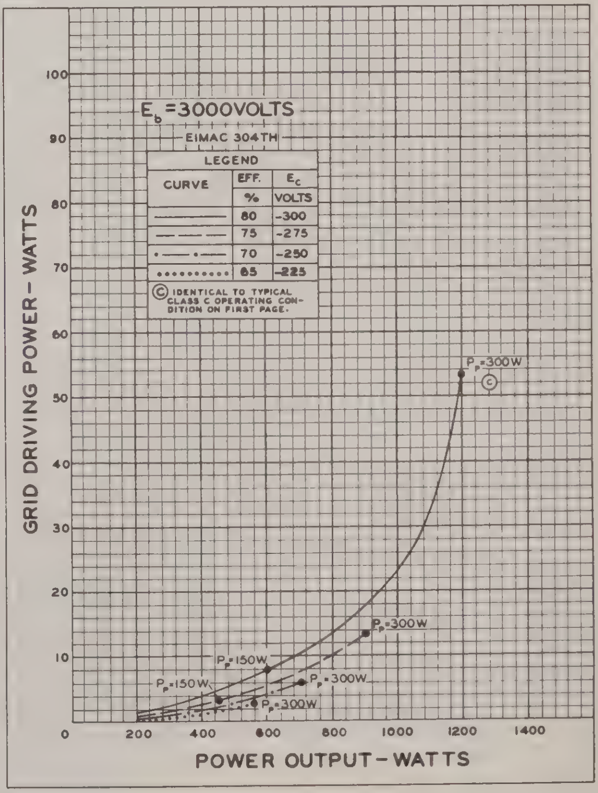
DRIVING POWER vs. POWER OUTPUT

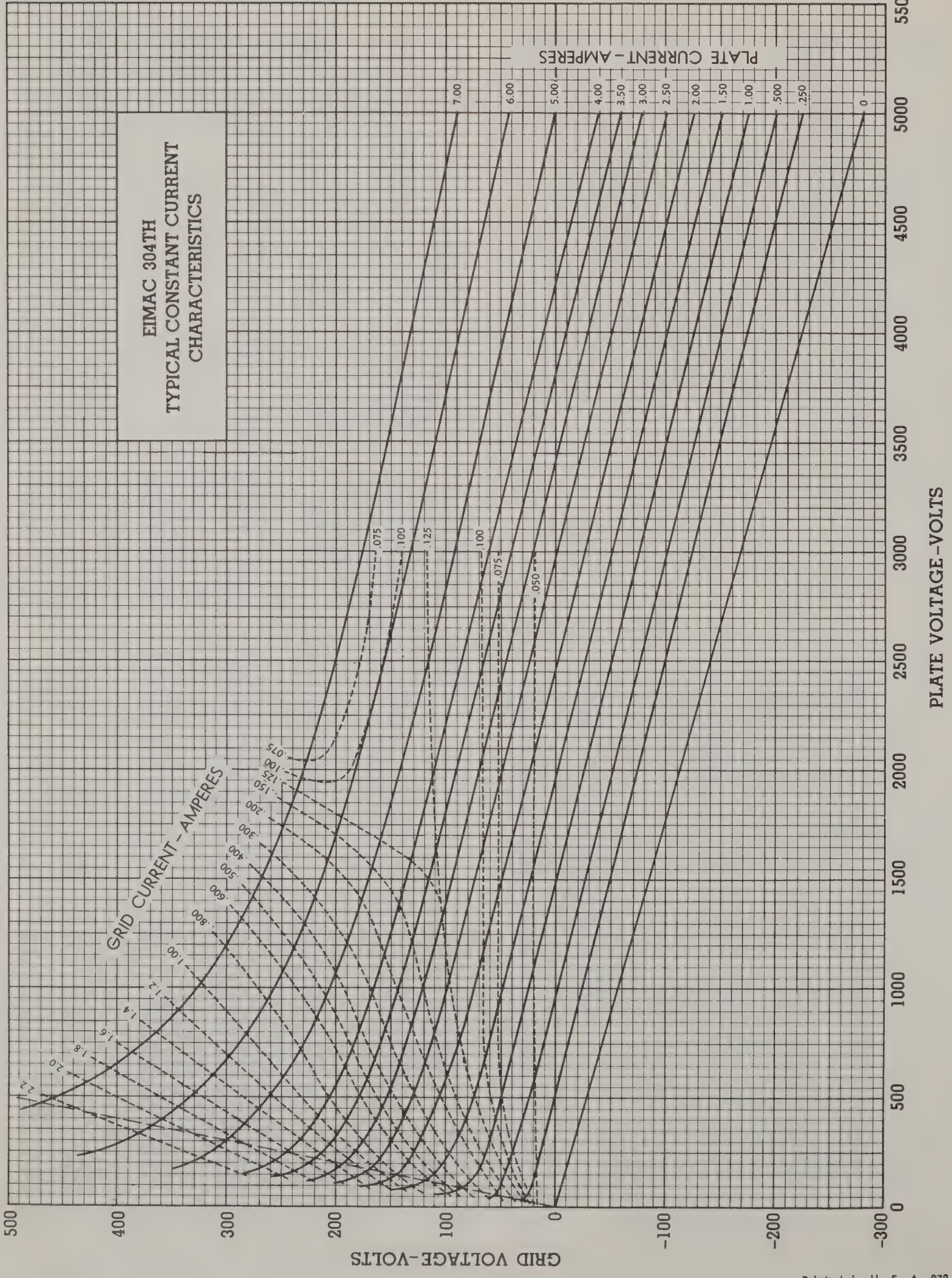
The three charts on this page show the relationship of plate efficiency, power output and approximate grid driving power at plate voltages of 1500, 2000 and 3000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by Pp.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 1500, 2000, and 3000 volts respectively.









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304TL

LOW-MU TRIODE

MODULATOR
OSCILLATOR
AMPLIFIER

The Eimac 304TL is a low-mu, power triode having a maximum plate dissipation rating of 300 watts, and is intended for use as an amplifier, oscillator or modulator, where maximum performance can be obtained at low plate voltage. It can be used at its maximum ratings at frequencies as high as 40-Mc.

Cooling of the 304TL is accomplished by radiation from the plate, which operates at a visible red color at maximum dissipation, and by means of air convection around the envelope.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated tungsten	
Voltage	5.0 or 10.0 volts
Current	25.0 or 12.5 amperes
Amplification Factor (Average)	12
Direct Interelectrode Capacitances (Average)	
Grid-Plate	8.6 $\mu\mu f$
Grid-Filament	12.1 $\mu\mu f$
Plate-Filament	.8 $\mu\mu f$
Transconductance (i_b=1.0 amp., E_b=3000 v, e_c= —175v.)	16,700 μmhos
Frequency for Maximum Ratings	40 Mc.

MECHANICAL

Base	Special 4 pin, No. 5000B
Basing	RMA type 4BC
Mounting	Vertical, base down or up
Cooling	Convection and Radiation
Recommended Heat Dissipating Connectors:	
Plate	HR-7
Grid	HR-6
Maximum Overall Dimensions:	
Length	7.625 inches
Diameter	3.563 inches
Net weight	9 ounces
Shipping weight (Average)	2 pounds

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class B (Sinusoidal wave, two tubes unless otherwise specified)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	3000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT, PER TUBE	900 MAX. MA.
PLATE DISSIPATION, PER TUBE	300 MAX. WATTS

TYPICAL OPERATION, CLASS AB_1

D-C Plate Voltage	1500	2000	2500	3000	Volts
D-C Grid Voltage (approx.)*	—118	—170	—230	—290	Volts
Zero-Signal D-C Plate Current	270	200	160	130	Ma.
Max-Signal D-C Plate Current	572	546	483	444	Ma.
Effective Load, Plate-to-Plate	2540	5300	8500	12,000	Ohms
Peak A-F Grid Input Voltage (per tube)	118	170	230	290	Volts
Max-Signal Peak Driving Power	0	0	0	0	Watts
Max-Signal Plate Power Output	256	490	610	730	Watts

*Adjust to give stated zero-signal plate current. The effective grid circuit resistance for each tube must not exceed 250,000 ohms.

TYPICAL OPERATION, CLASS AB_2

D-C Plate Voltage	1500	2000	2500	3000	Volts
D-C Grid Voltage (approx.)*	—118	—170	—230	—290	Volts
Zero-Signal D-C Plate Current	270	200	160	130	Ma.
Max-Signal D-C Plate Current	1140	1000	900	800	Ma.
Effective Load, Plate-to-Plate	2750	4500	6600	9100	Ohms
Peak A-F Grid Input Voltage (per tube)	245	290	340	390	Volts
Max-Signal Peak Driving Power	78	87	95	110	Watts
Max-Signal Nominal Driving Power (approx.)	39	44	48	55	Watts
Max-Signal Plate Power Output	1100	1400	1650	1800	Watts

*Adjust to give stated zero-signal plate current.

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PLATE MODULATED RADIO FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	2500 MAX. VOLTS
D-C PLATE CURRENT	700 MAX. MA.
PLATE DISSIPATION	200 MAX. WATTS
GRID DISSIPATION	50 MAX. WATTS

TYPICAL OPERATION (Power input limited to 500 and 1000 watts)*

D-C Plate Voltage	2000	2000	2500	2500	Volts
D-C Plate Current	250	500	200	400	Ma.
Total Bias Voltage	—500	—500	—525	—550	Volts
Fixed Bias Voltage	—410	—275	—300	—300	Volts
Grid Resistor	3000	3000	12,500	5000	Ohms
D-C Grid Current	30	75	18	50	Ma.
Peak R-F Grid Input Voltage	615	690	620	715	Volts
Driving Power	18	52	11	36	Watts
Grid Dissipation	3	15	2	9	Watts
Plate Power Input	500	1000	500	1000	Watts
Plate Dissipation	90	190	75	170	Watts
Plate Power Output	410	810	425	830	Watts

*The figures are for convenience in obtaining a 500 or 1000 Watt carrier input per tube to the modulated amplifier. The output figures do not allow for circuit losses.

TYPICAL OPERATION*

D-C Plate Voltage	1500	2000	2500	Volts
D-C Plate Current	520	525	450	Ma.
Total Bias Voltage	—370	—500	—550	Volts
Fixed Bias Voltage	—160	—260	—440	Volts
Grid Resistor	2800	3000	2000	Ohms
D-C Grid Current	75	80	55	Ma.
Peak R-F Grid Input Voltage	545	695	720	Volts
Driving Power	41	55	40	Watts
Grid Dissipation	13	15	10	Watts
Plate Power Input	780	1050	1125	Watts
Plate Dissipation	200	200	200	Watts
Power Output	580	850	925	Watts

*The figures are for one tube operating at maximum plate dissipation as a plate modulated Class C amplifier. The output figures do not allow for circuit losses.

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony
(Key-down conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE - - - - -	3000 MAX. VOLTS
D-C PLATE CURRENT - - - - -	900 MAX. MA.
PLATE DISSIPATION - - - - -	300 MAX. WATTS
GRID DISSIPATION - - - - -	50 MAX. WATTS

TYPICAL OPERATION*				
D-C Plate Voltage - - - - -	1500	2000	3000	Volts
D-C Grid Voltage - - - - -	—250	—300	—400	Volts
D-C Plate Current - - - - -	665	600	500	Ma.
D-C Grid Current - - - - -	90	85	80	Ma.
Peak R-F Grid Input Voltage - -	430	480	575	Volts
Driving Power (approx.) - - -	33	36	40	Watts
Grid Dissipation - - - - -	11	11	8	Watts
Plate Power Input - - - - -	1000	1200	1500	Watts
Plate Dissipation - - - - -	300	300	300	Watts
Plate Power Output - - - -	700	900	1200	Watts

*The figures show actual measured tube performance, and do not allow for circuit losses.

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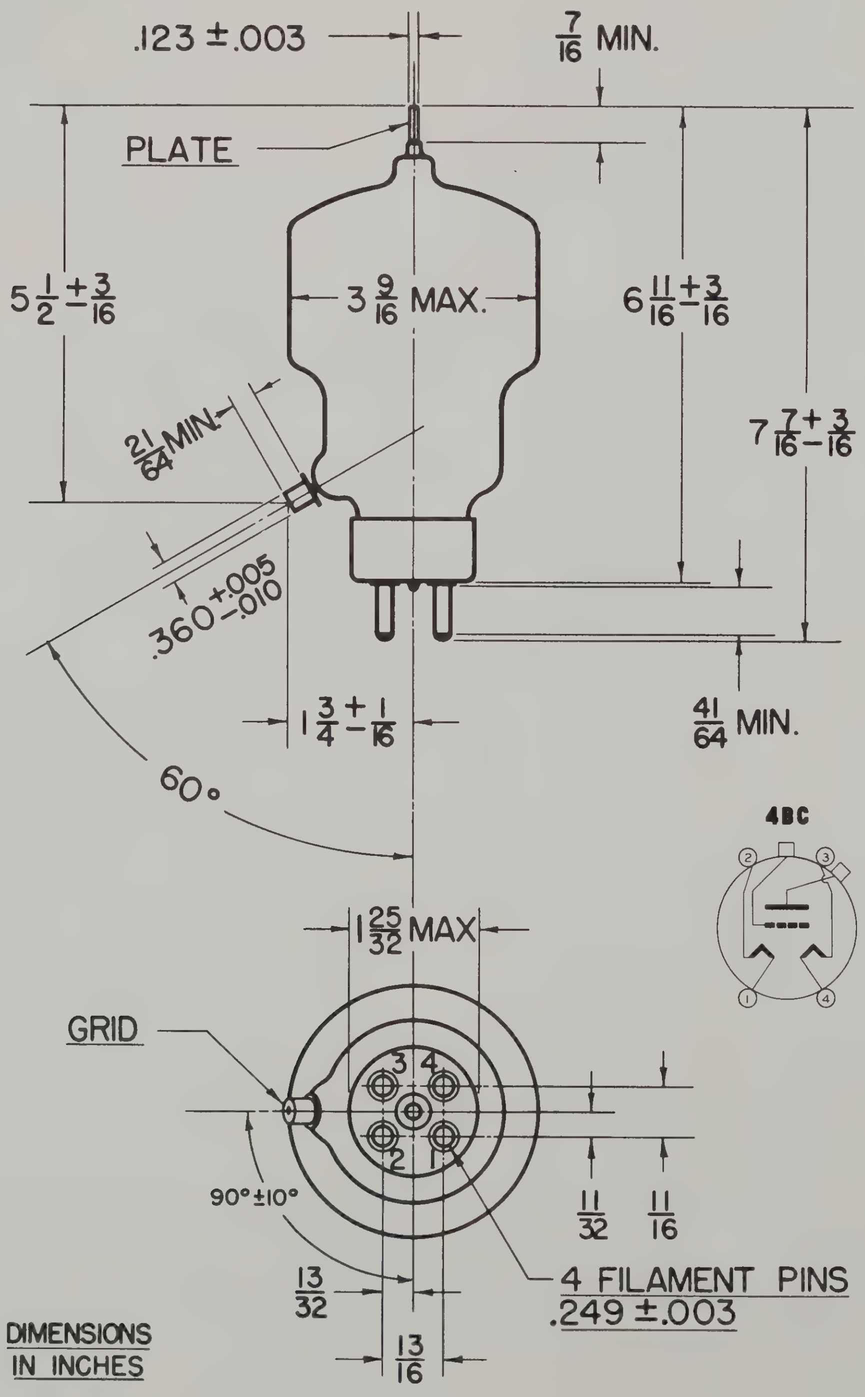
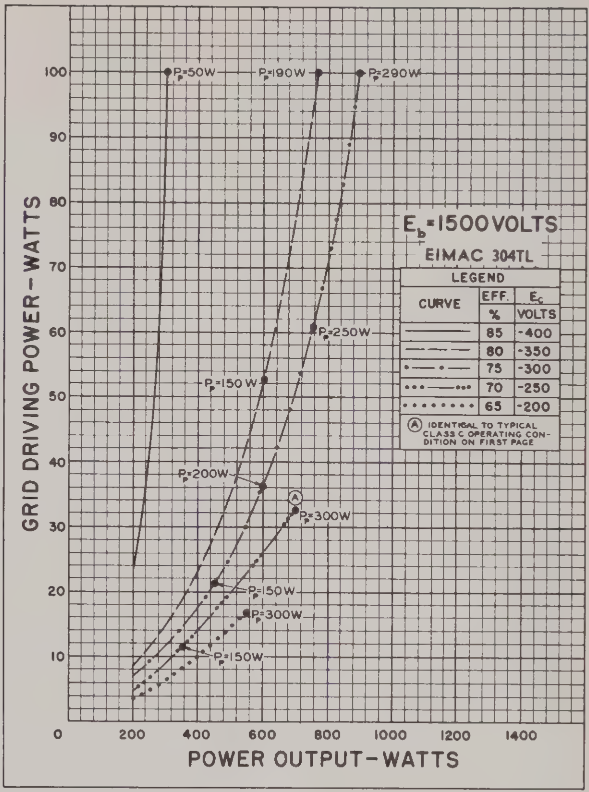


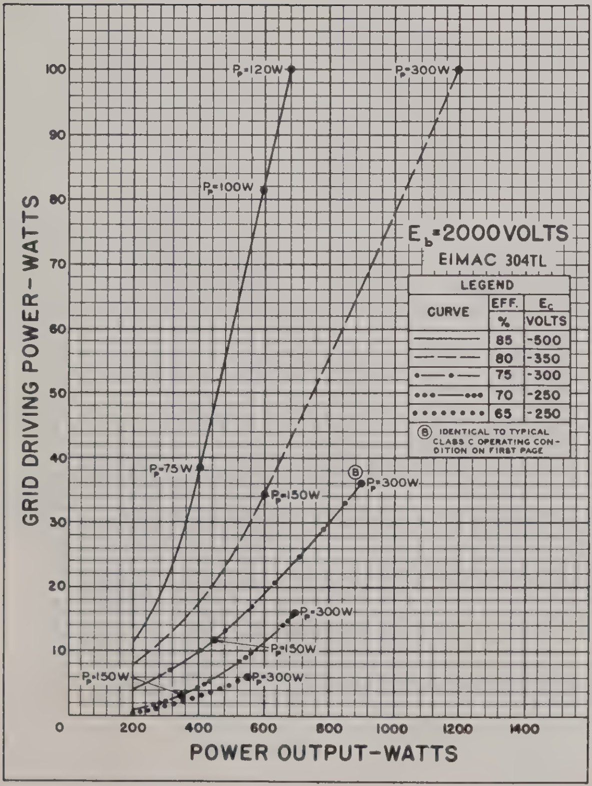
▶ Indicates change from sheet dated 5-1-49

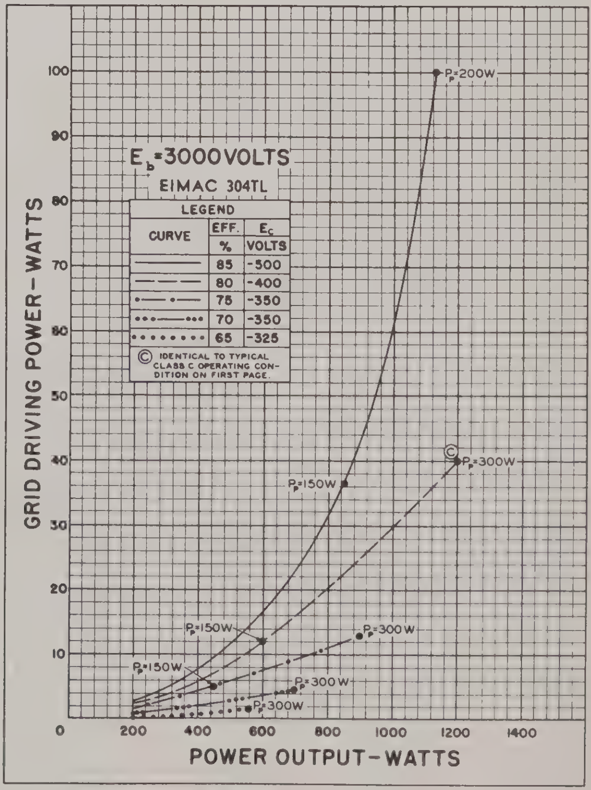
DRIVING POWER vs. POWER OUTPUT

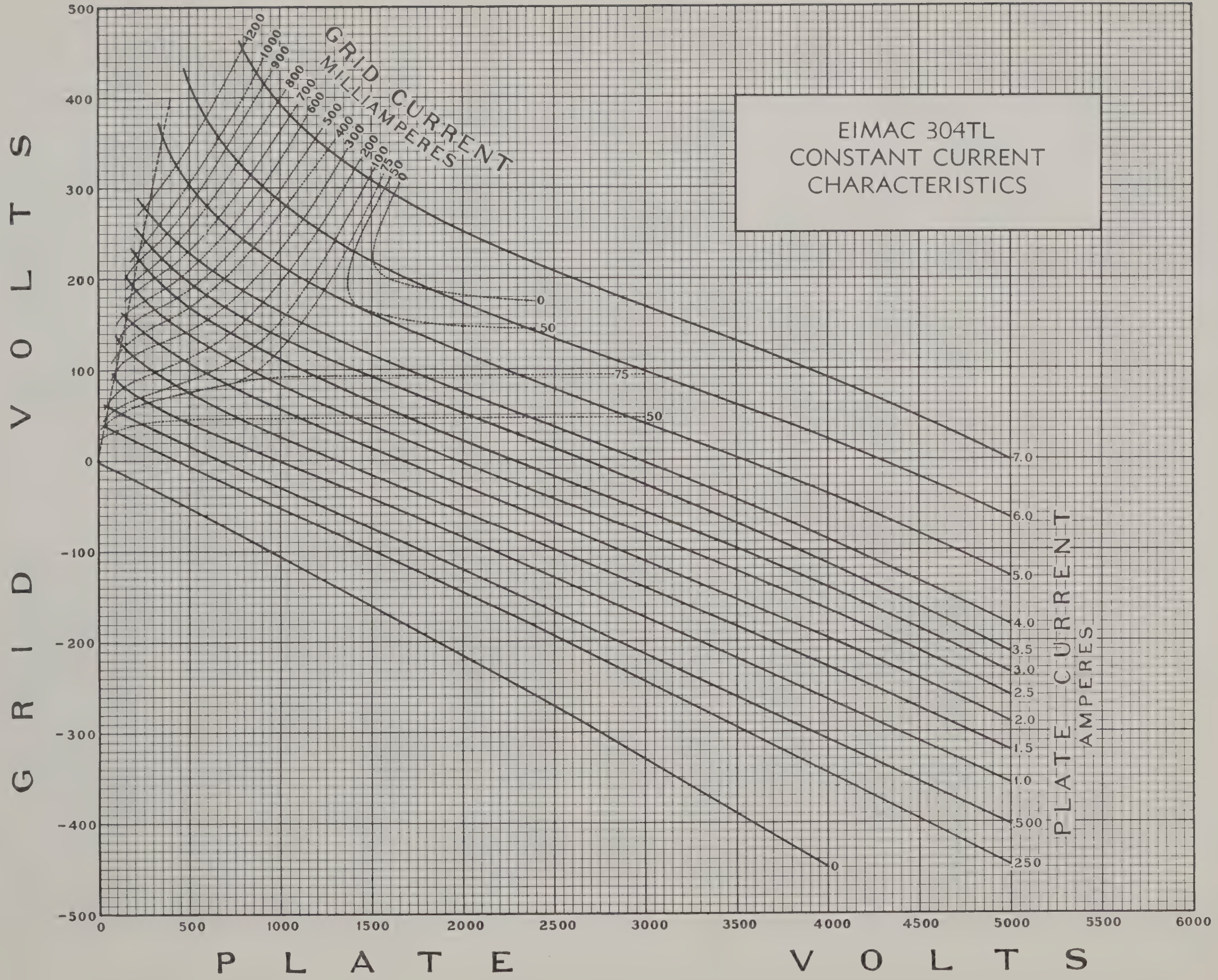
The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 1500, 2000 and 3000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 1500, 2000, and 3000 volts respectively.









EIMAC 304TL
CONSTANT CURRENT
CHARACTERISTICS

Eimac®

EITEL-McCULLOUGH, INC.
SAN CARLOS · CALIFORNIA

450TH

HIGH-MU TRIODE

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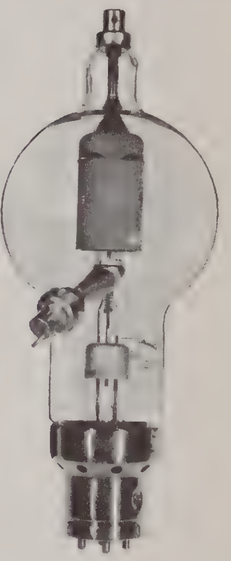
MODULATOR
OSCILLATOR
AMPLIFIER



The Eimac 450TH is a high-mu power triode having a maximum plate dissipation rating of 450 watts, and is intended for use as an amplifer, oscillator and modulator. It can be used at its maximum ratings at frequencies as high as 40 Mc.

Cooling of the 450TH is accomplished by radiation from the plate, which operates at a visible red color at maximum dissipaton, and by means of air circulation around the envelope.

GENERAL CHARACTERISTICS

▶ ELECTRICAL

Filament: Thoriated tungsten

Voltage	7.5 volts
Current	12.0 amperes

Note: Dual connections for each filament lead are provided within the base of the tube (see basing diagram). Corresponding socket terminals must be connected in parallel to provide proper distribution of filament and R-F charging currents.

Amplification Factor (Average)	38
Direct Interelectrode Capacitances (Average)	
Grid-plate	5.0 $\mu\mu$fd.
Grid-Filament	8.8 $\mu\mu$fd.
Plate-Filament	0.8 $\mu\mu$fd.
Transconductance (i_b=500 ma., E_b=4000 v.)	6650 μmhos
Frequency for maximum ratings	40 Mc.

▶ MECHANICAL

Base	Special 4 pin, No. 5002B
Basing	RMA type 4AQ
Mounting	Vertical, base down or up
Cooling	Radiation and air circulation

Note: Adequate ventilation or air cooling must be provided so that the seals and envelope do not exceed 200°C under operating conditions.

Socket	Johnson Type No. 211 or National Type No. XM50 or equivalent.
Recommended Heat Dissipating Connectors:	
Plate	Eimac HR-8
Grid	Eimac HR-8

Note: The grid terminal of the 450TH is now .560" in diameter. To accommodate existing equipment designed for the older style 450TH having .098" diameter grid terminals, an adapter pin is provided with the newer tubes. This adapter pin is threaded so that it may be removed from the grid terminal of the tube. The small grid terminal, if used, requires an HR-4 heat dissipating connector. (See outline drawing.)

Maximum Overall Dimensions:	
Length	12.625 inches
Diameter	5.125 inches
Net weight	1.3 pounds
Shipping weight (Average)	5.6 pounds

▶ AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class AB_2 (Sinusoidal wave, two tubes unless otherwise specified)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	6000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT PER TUBE	600 MAX. MA.
PLATE DISSIPATION, PER TUBE	450 MAX. WATTS

TYPICAL OPERATION—2 TUBES				
D-C Plate Voltage	3000	4000	5000	Volts
D-C Grid Voltage (approx.)*	—50	—85	—115	Volts
Zero-Signal D-C Plate Current	200	150	120	Ma.
Max-Signal D-C Plate Current	770	675	620	Ma.
Effective Load, Plate-to-Plate	7800	12,800	18,600	Ohms
Peak A-F Grid Input Voltage (per tube)	225	235	267	Volts
Max-Signal Peak Driving Power	40	34	40	Watts
Max-Signal Nominal Driving Power (approx.)	20	17	20	Watts
Max-Signal Plate Power Output	1400	1800	2200	Watts

*Adjust to give stated zero-signal plate current.

▶ PLATE MODULATED RADIO FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	4500 MAX. VOLTS
D-C PLATE CURRENT	500 MAX. MA.
PLATE DISSIPATION	300 MAX. WATTS
GRID DISSIPATION	80 MAX. WATTS

TYPICAL OPERATION, PER TUBE*				
D-C Plate Voltage	3000	4000	4500	Volts
D-C Plate Current	380	340	345	Ma.
Total Bias Voltage	—250	—300	—350	Volts
Fixed Bias Voltage	—100	—150	—175	Volts
Grid Resistor	2500	3500	3500	Ohms
D-C Grid Current	60	43	50	Ma.
Peak R-F Grid Input Voltage	490	525	585	Volts
Driving Power (approx.)	30	23	29	Watts
Grid Dissipation	14	10	12	Watts
Plate Power Input	1150	1360	1550	Watts
Plate Dissipation	300	300	300	Watts
Plate Power Output	850	1060	1250	Watts

*The figures are for one tube operating at maximum plate dissipation as a plate modulated Class-C amplifier. The output figures do not allow for circuit losses.

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▶ Indicates change from sheet dated 10-1-49.

▶ RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony (Key-down conditions, per tube).

MAXIMUM RATINGS

D-C PLATE VOLTAGE	6000 MAX. VOLTS
D-C PLATE CURRENT	600 MAX. MA.
PLATE DISSIPATION	450 MAX. WATTS
GRID DISSIPATION	80 MAX. WATTS

TYPICAL OPERATION, PER TUBE*

D-C Plate Voltage	3000	4000	5000	Volts
D-C Grid Voltage	—175	—200	—300	Volts
D-C Plate Current	500	450	450	Ma.
D-C Grid Current	95	85	90	Ma.
Peak R-F Grid Input Voltage	400	410	570	Volts
Driving Power (approx.)	35	35	46	Watts
Grid Dissipation	21	18	24	Watts
Plate Power Input	1500	1800	2250	Watts
Plate Dissipation	450	450	450	Watts
Plate Power Output	1050	1350	1800	Watts

*The figures show actual measured tube performance and do not allow for circuit losses.

APPLICATION

MECHANICAL

Mounting—The 450TH must be mounted vertically, base up or base down. Flexible connecting straps should be provided from the grid and plate terminals to the external grid and plate circuits. The tube must be protected from severe vibration and shock.

▶ **Cooling**—Provision should be made for ample circulation of air around the 450TH. In the event that the design of the equipment restricts natural circulation, the use of a small fan or centrifugal blower to provide additional cooling for the tube will aid in obtaining maximum tube life. Special heat-dissipating connectors (Eimac HR-8) are available for use on the plate and grid terminals. These connectors help to prolong tube life by reducing the temperature of the seals.

ELECTRICAL

▶ **Filament Voltage**—For maximum tube life the filament voltage, as measured directly at the filament pins, should be the rated value of 7.5 volts. Unavoidable variations in fialment voltage must be kept within the range from 7.03 to 7.88 volts. All four socket terminals should be used, putting two in parallel for each filament connection.

Bias Voltage—Although there is no maximum limit on the bias voltage which may be used on the 450TH, there is little advantage in using bias voltages in excess of those given under "Typical Operation," except in certain very specialized applications. Where bias is obtained by a grid leak, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation.

Grid Dissipation—The power dissipated by the grid of the 450TH must not exceed 80 watts. Grid dissipation may be calculated from the following expression:

$$P_g = e_{cmp} I_c$$

where P_g = Grid dissipation,

e_{cmp} = Peak positive grid voltage, and

I_c = D-c grid current.

e_{cmp} may be measured by means of a suitable peak voltmeter connected between filament and grid.[1] In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any conditions of loading.

Plate Voltage—Except in very special applications, the plate supply voltage for the 450TH should not exceed 6000 volts. In most cases there is little advantage in using plate-supply voltages higher than those given under "Typical Operation" for the power output desired.

▶ **Plate Dissipation**—Under normal operating conditions, the power dissipated by the plate of the 450TH should not be allowed to exceed 450 watts. At this dissipation the brightness temperature of the plate will appear a visible red color. The value of this color is somewhat effected by light from the filament as well as from external sources. Plate dissipation in excess of the maximum rating is permissible for short periods of time, such as during tuning procedures.

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[1] For suitable peak v.t.v.m. circuits see, for instance, "Vacuum Tube Ratings," **Eimac News**, January, 1945. This article is available in reprint form on request.

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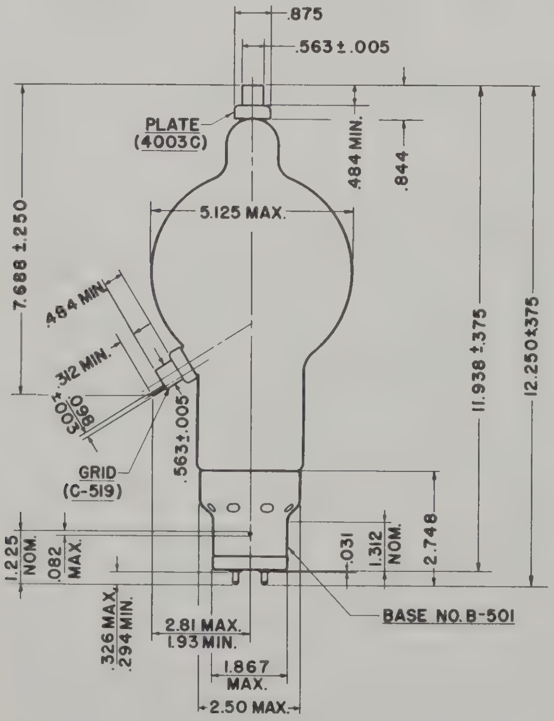

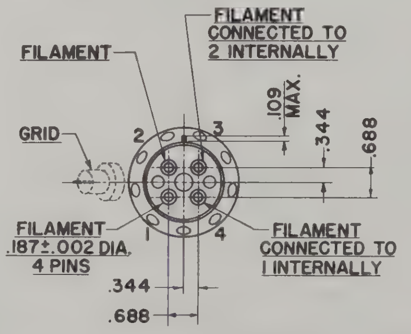
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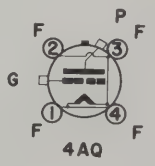
BOTTOM VIEW



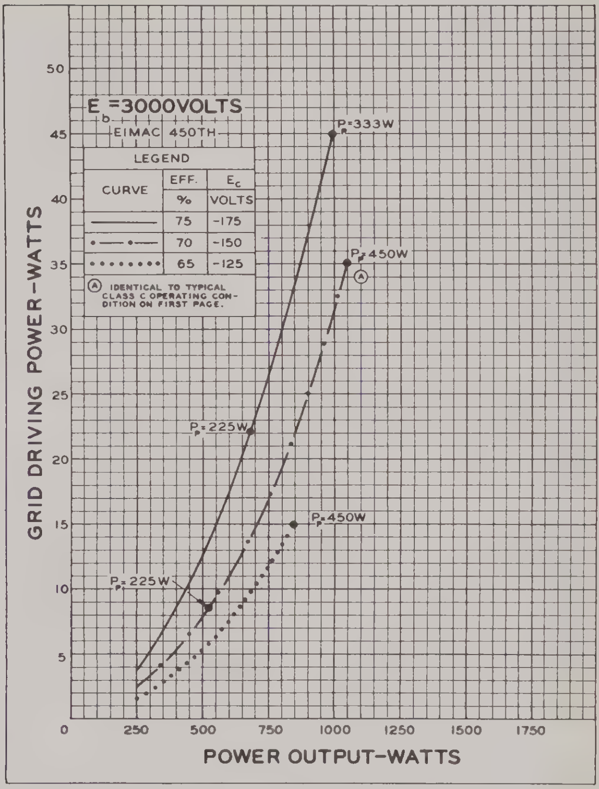
NOTE:—The grid terminal on the new 450TH and TL type tube is now .563" in diameter. To accommodate existing equipment which uses the 450TH or TL tubes with the old style .098" grid terminal, an adapter pin is provided. This adapter pin, if not needed, may be removed by unscrewing.

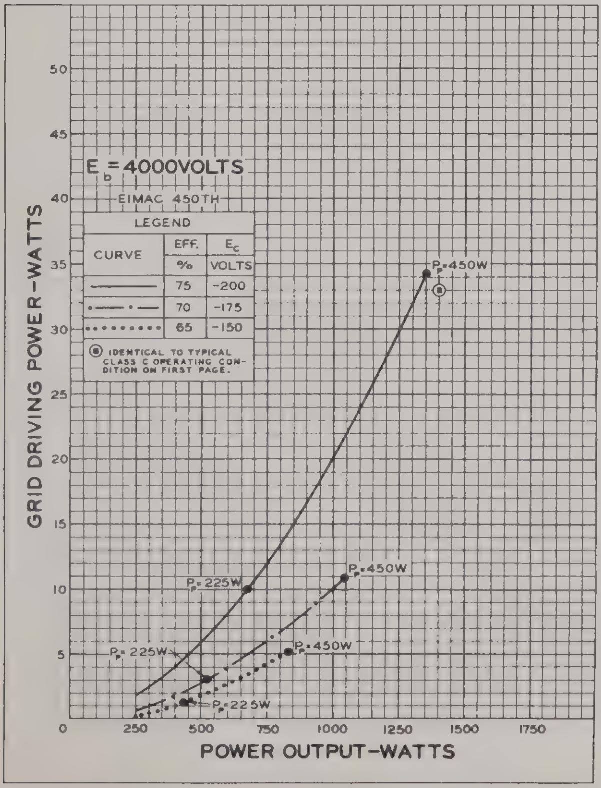
▶ Indicates change from sheet dated 10-1-49

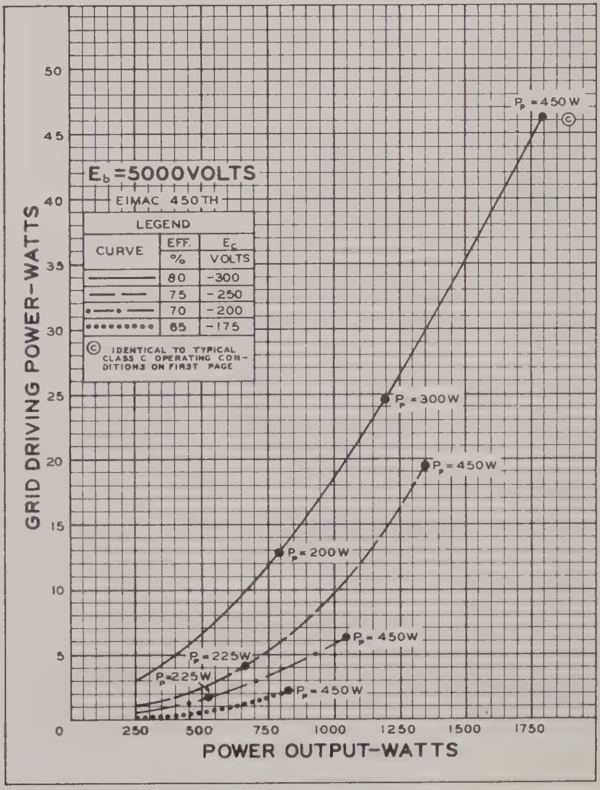
DRIVING POWER vs. POWER OUTPUT

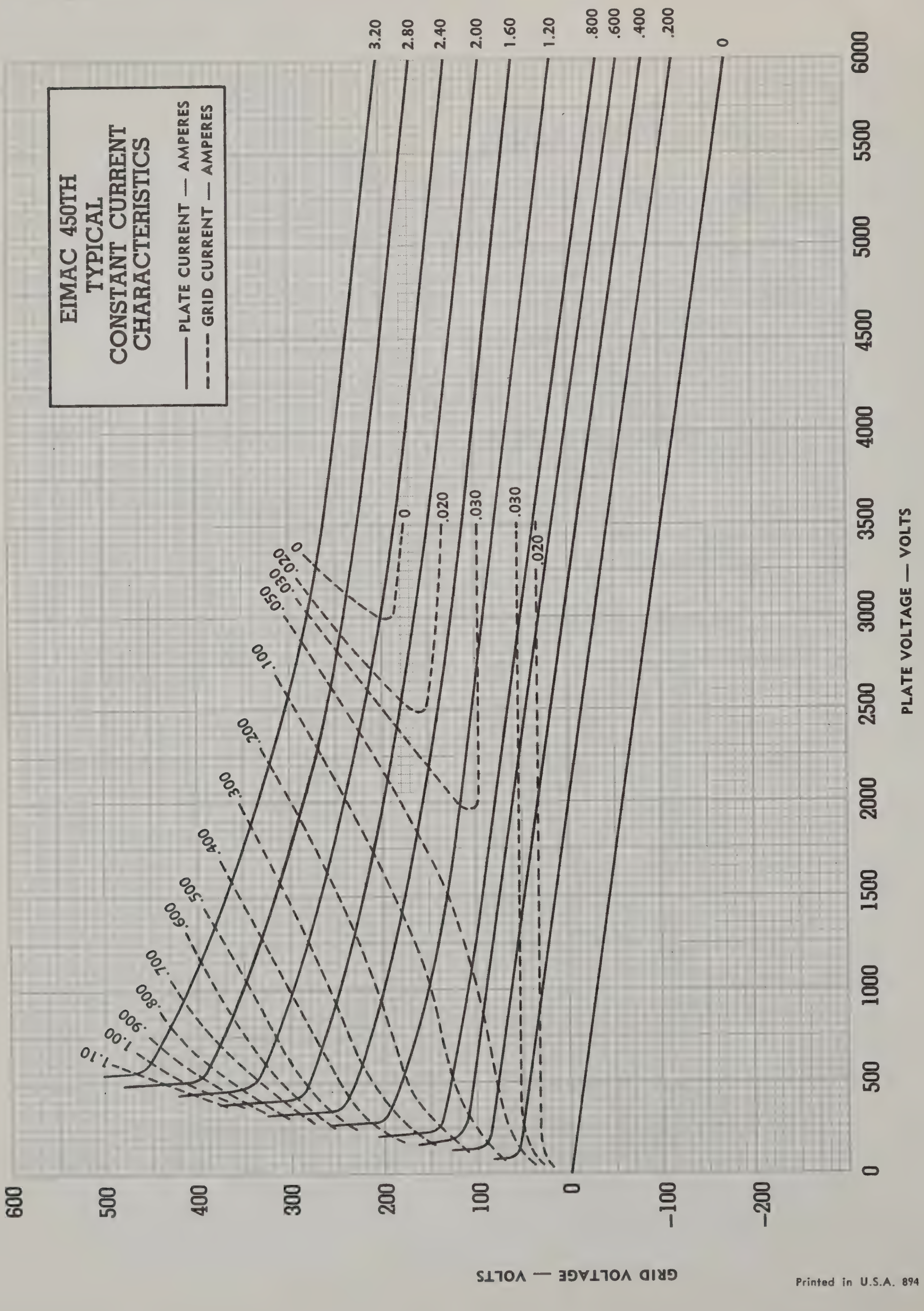
The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 3000, 4000, and 5000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 3000, 4000, and 5000 volts respectively.









EIMAC 450TH TYPICAL CONSTANT CURRENT CHARACTERISTICS

Eimac®

EITEL-McCULLOUGH, INC.
SAN BRUNO CALIFORNIA

450TL

MEDIUM-MU TRIODE
•
MODULATOR
OSCILLATOR
AMPLIFIER

The Eimac 450TL is a medium-mu power triode having a maximum plate dissipation rating of 450 watts, and is intended for use as an amplifier, oscillator and modulator. It can be used at its maximum ratings at frequencies as high as 40-Mc.

Cooling of the 450TL is accomplished by radiation from the plate, which operates at a visible red color at maximum dissipation, and by means of air circulation around the envelope.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated tungsten

Voltage	7.5 volts
Current	12.0 amperes

Note: Dual connections for each filament lead are provided within the base of the tube (see basing diagram). Corresponding socket terminals must be connected in parallel to provide proper distribution of filament and R-F charging currents.

Amplification Factor (Average)	18
Direct Interelectrode Capacitances (Average)	
Grid-Plate	4.5 μμf
Grid-Filament	6.8 μμf
Plate-Filament	0.8 μμf
Transconductance (i_b=500ma, E_b=4000v, e_c= —75v.)	5000 μmhos
Frequency for Maximum Ratings	40-Mc.

MECHANICAL

Base	Special 4 pin, No. 5002B
Basing	RMA type 4AQ
Mounting	Vertical, base down or up
Cooling	Radiation and air circulation

Note: Adequate ventilation or air cooling must be provided so that the seals and envelope do not exceed 200°C under operating conditions.

Socket	Johnson Type No. 211 or National Type No. XM50 or equivalent.

Recommended Heat Dissipating Connectors:

Plate	Eimac HR-8
Grid	Eimac HR-8

Note: The grid terminal of the 450TL is now .560" in diameter. To accommodate existing equipment designed for the older style 450TL having .098" diameter grid terminals, an adapter pin is provided with the newer tubes. This adapter pin is threaded so that it may be removed from the grid terminal of the tube. The small grid terminal, if used, requires an HR-4 heat dissipating connector. (See outline drawing.)

Maximum Overall Dimensions:

Length	12.625 inches
Diameter	5.125 inches
Net weight	1.3 pounds
Shipping weight (Average)	5.6 pounds

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class AB_2 (Sinusoidal wave, two tubes unless otherwise specified)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	6000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT PER TUBE	600 MAX. MA.
PLATE DISSIPATION, PER TUBE	450 MAX. WATTS

TYPICAL OPERATION—2 TUBES				
D-C Plate Voltage	3000	4000	5000	Volts
D-C Grid Voltage (approx.)*	—110	—175	—240	Volts
Zero-Signal D-C Plate Current	200	150	120	Ma.
Max-Signal D-C Plate Current	770	675	620	Ma.
Effective Load, Plate-to-Plate	7700	12,800	18,500	Ohms
Peak A-F Grid Input Voltage (per tube)	325	365	430	Volts
Max-Signal Peak Driving Power	40	33	56	Watts
Max-Signal Nominal Driving Power (approx.)	20	17	28	Watts
Max-Signal Plate Power Output	1400	1800	2200	Watts

*Adjust to give stated zero-signal plate current.

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony (Key-down conditions, per tube).

MAXIMUM RATINGS

D-C PLATE VOLTAGE	6000 MAX. VOLTS
D-C PLATE CURRENT	600 MAX. MA.
PLATE DISSIPATION	450 MAX. WATTS
GRID DISSIPATION	65 MAX. WATTS

TYPICAL OPERATON, PER TUBE*				
D-C Plate Voltage	3000	4000	5000	Volts
D-C Grid Voltage	—275	—400	—500	Volts
D-C Plate Current	500	450	450	Ma.
D-C Grid Current	65	53	54	Ma.
Peak R-F Grid Input Voltage	640	740	870	Volts
Driving Power (approx.)	38	35	42	Watts
Grid Dissipation	20	13	15	Watts
Plate Power Input	1500	1800	2250	Watts
Plate Dissipation	450	450	450	Watts
Plate Power Output	1050	1350	1800	Watts

*The figures show actual measured tube performance and do not allow for circuit losses.

PLATE MODULATED RADIO FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	4500 MAX. VOLTS
D-C PLATE CURRENT	500 MAX. MA.
PLATE DISSIPATION	300 MAX. WATTS
GRID DISSIPATION	65 MAX. WATTS

TYPICAL OPERATION, PER TUBE*				
D-C Plate Voltage	3000	4000	4500	Volts
D-C Plate Current	380	340	345	Ma.
Total Bias Voltage	—400	—500	—550	Volts
Fixed Bias Voltage	—200	—250	—275	Volts
Grid Resistor	5000	7000	7500	Ohms
D-C Grid Current	40	36	36	Ma.
Peak R-F Grid Input Voltage	700	790	850	Volts
Driving Power	28	29	31	Watts
Grid Dissipation	12	11	11	Watts
Plate Power Input	1150	1360	1550	Watts
Plate Dissipation	300	300	300	Watts
Plate Power Output	850	1060	1250	Watts

*The figures are for one tube operating at maximum plate dissipation as a plate modulated Class-C amplifier. The output figures do not allow for circuit losses.

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APPLICATION

MECHANICAL

Mounting—The 450TL must be mounted vertically, base up or base down. Flexible connecting straps should be provided from the grid and plate terminals to the external grid and plate circuits. The tube must be protected from severe vibration and shock.

Cooling—Provision should be made for ample circulation of air around the 450TL. In the event that the design of the equipment restricts natural circulation, the use of a small fan or centrifugal blower to provide additional cooling for the tube will aid in obtaining maximum tube life. Special heat-dissipating connectors (Eimac HR-8) are available for use on the plate and grid terminals. These connectors help to prolong tube life by reducing the temperature of the seals.

ELECTRICAL

Filament Voltage—For maximum tube life the filament voltage, as measured directly at the filament pins, should be the rated value of 7.5 volts. Unavoidable variations in filament voltage must be kept within the range from 7.03 to 7.88 volts. All four socket terminals should be used, putting two in parallel for each filament connection.

Bias Voltage—Although there is no maximum limit on the bias voltage which may be used on the 450TL, there is little advantage in using bias voltages in excess of those given under "Typical Operation," except in certain very specialized applications. Where bias is obtained by a grid leak, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation.

Grid Dissipation—The power dissipated by the grid of the 450TL must not exceed 65 watts. Grid dissipation may be calculated from the following expression:

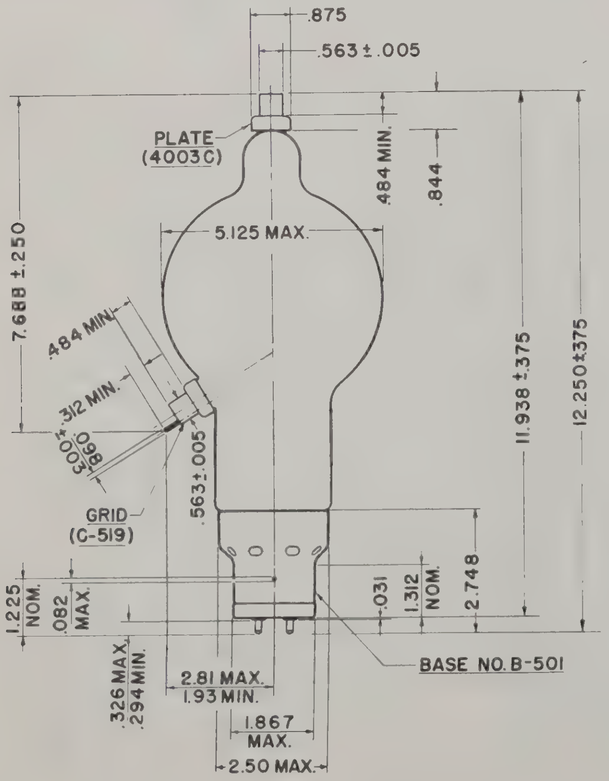
$$P_g = e_{cmp} I_c$$

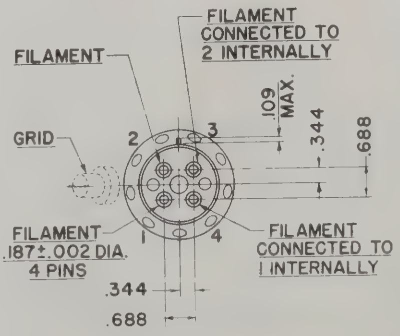
where P_g = Grid dissipation
e_{cmp} = Peak positive grid voltage, and
I_c = D-c grid current.

e_{cmp} may be measured by means of a suitable peak voltmeter connected between filament and grid. In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any conditions of loading.

Plate Voltage—Except in very special applications, the plate supply voltage for the 450TL should not exceed 6000 volts. In most cases there is little advantage in using plate-supply voltages higher than those given under "Typical Operation" for the power output desired.

Plate Dissipation—Under normal operating conditions, the power dissipated by the plate of the 450TL should not be allowed to exceed 450 watts. At this dissipation the brightness temperature of the plate will appear a red-orange in color. The value of this color is somewhat affected by light from the filament as well as from external sources. Plate dissipation in excess of the maximum rating is permissible for short periods of time, such as during tuning procedures.

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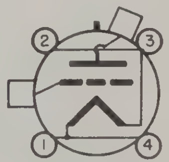

NOTE:—The grid terminal on the new 450TH and TL type tube is now .563" in diameter. To accommodate existing equipment which uses the 450TH or TL tubes with the old style .098" grid terminal, an adaptor pin is provided. This adaptor pin, if not needed, may be removed by unscrewing.

DRIVING POWER vs. POWER OUTPUT

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The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 3000, 4000, and 5000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 3000, 4000, and 5000 volts respectively.

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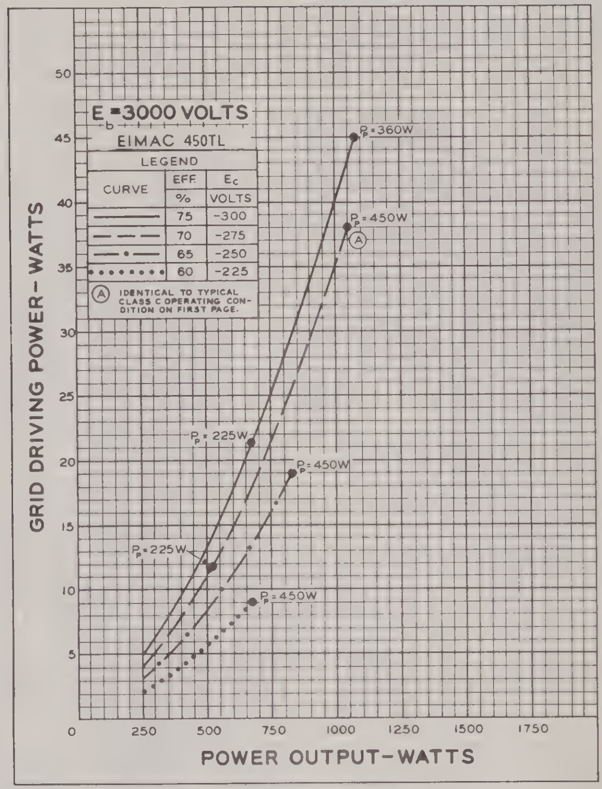

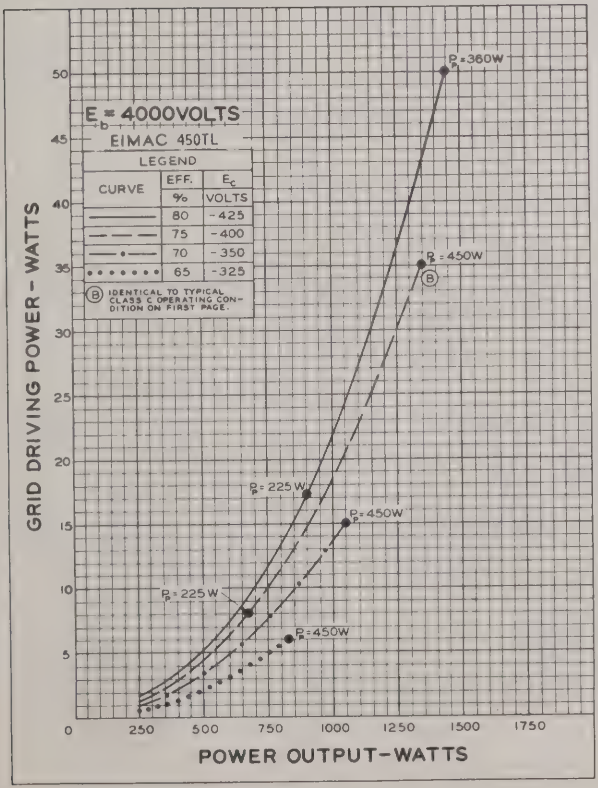

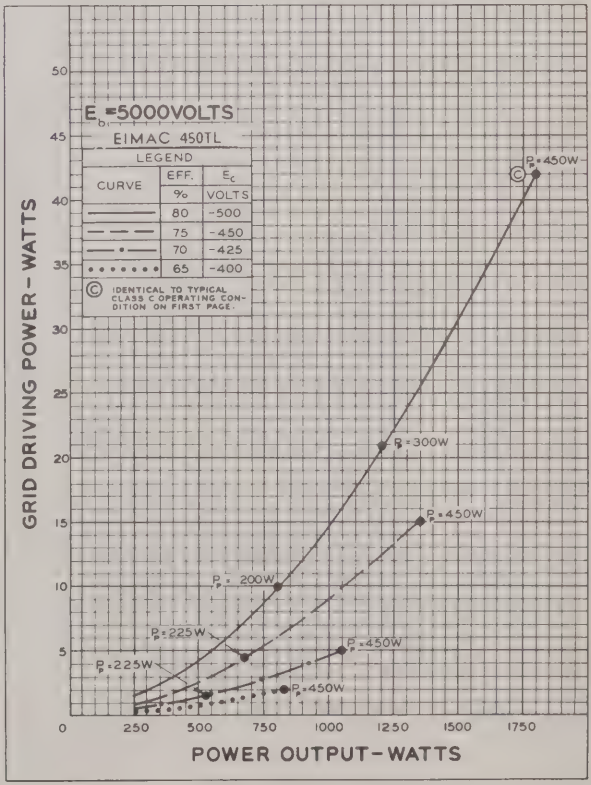

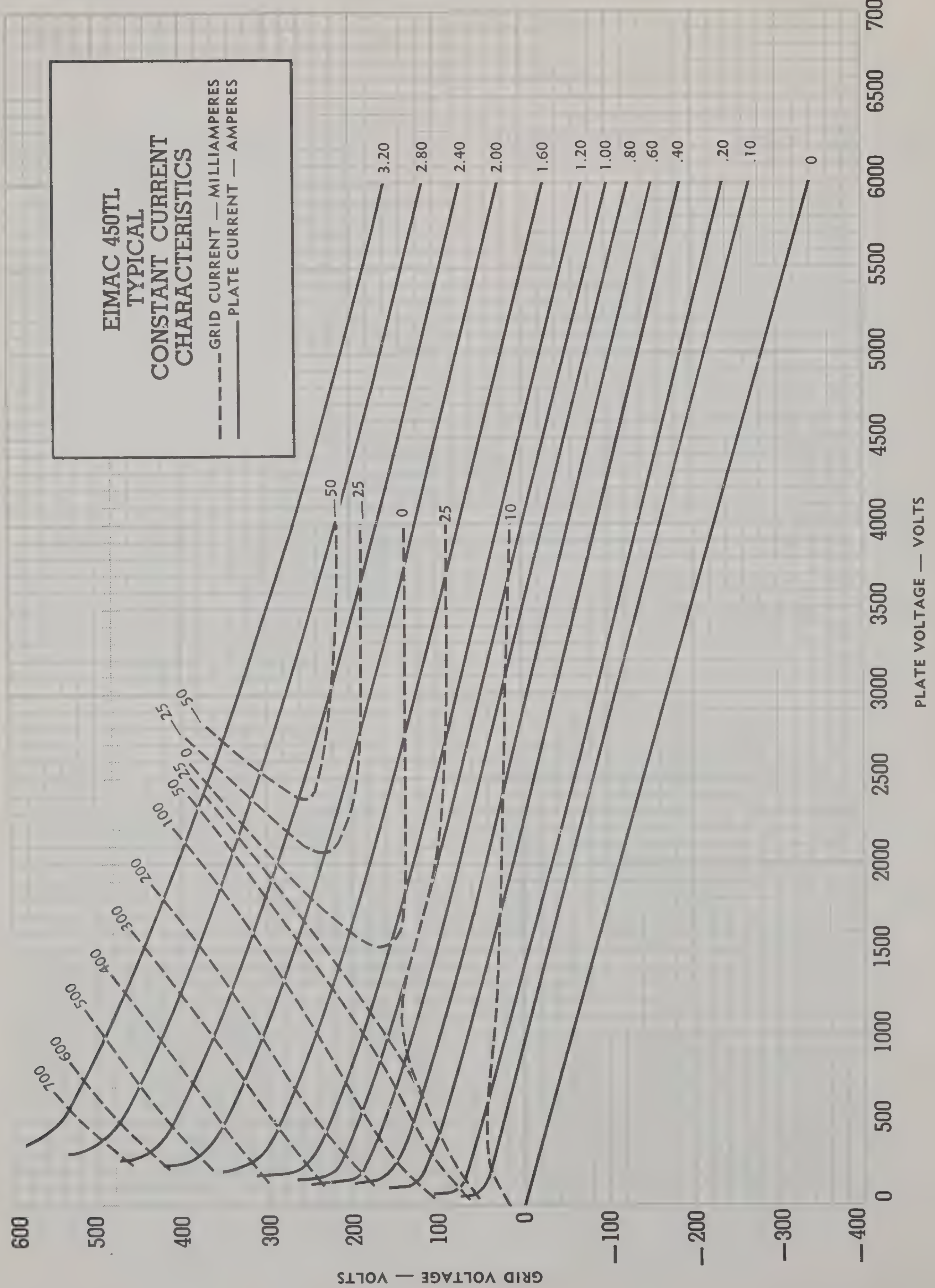

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MEDIUM-MU TRIODE

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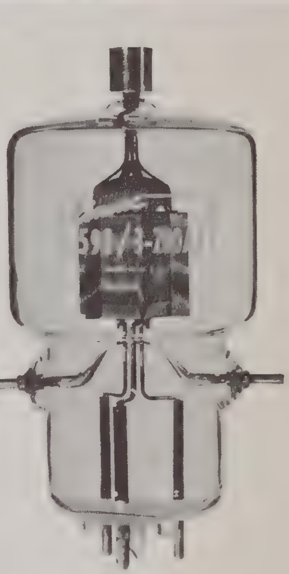
MODULATOR
OSCILLATOR
AMPLIFIER



The Eimac 592/3-200A3 is a medium-mu power triode having a maximum plate dissipation rating of 200 watts, and it is intended for use as a power amplifier, oscillator, or modulator. It can be used at its maximum ratings at frequencies as high as 150 Mc.

Cooling of the 592/3-200A3 is accomplished by radiation from the plate, which operates at a visible red color at maximum plate dissipation, and by means of forced-air circulation around the envelope.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated tungsten	
Voltage	10.0 volts
Current	5.0 amperes
Amplification Factor (Average)	25
Direct Interelectrode Capacitances (Average)	
Grid-Plate	3.3 μμf
Grid-Filament	3.6 μμf
Plate-Filament	0.29 μμf
Transconductance ($I_b = 200$ ma., $E_b = 3000$ v.)	3600 μmhos
Frequency for Maximum Ratings	150 Mc.

MECHANICAL

Mounting	Vertical
Maximum Over-all Dimensions:	
Length	6.0 inches
Diameter	3-13/32 inches
Net Weight (approx.)	6 ounces
Shipping Weight (approx.)	1½ pounds
Cooling	Radiation and Forced-Air
Recommended Heat Dissipating Connectors:	
Plate	Eimac HR-10
Grid	Eimac HR-5
Maximum bulb temperature	225° C
Maximum seal temperature	175° C

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

MAXIMUM RATINGS, PER TUBE

D-C PLATE VOLTAGE	3500 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT	250 MAX. MA.
PLATE DISSIPATION	200 MAX. WATTS
GRID DISSIPATION	25 MAX. WATTS

TYPICAL OPERATION

Sinusoidal wave, two tubes unless otherwise specified.

D-C Plate Voltage	2000	2500	3000	Volts
D-C Grid Voltage (approx.)*	—50	—70	—90	Volts
Zero-Signal D-C Plate Current	120	100	80	Ma.
Max-Signal D-C Plate Current	500	450	400	Ma.
Effective Load, Plate-to-Plate	8500	12,600	18,000	Ohms
Peak A-F Grid Input Voltage (per tube)	260	270	270	Volts
Max-Signal Peak Driving Power	50	52	40	Watts
Max-Signal Nominal Driving Power (approx.)	25	26	20	Watts
Max-Signal Plate Power Output	600	725	820	Watts

*Adjust to give stated zero-signal plate current.

PLATE MODULATED RADIO FREQUENCY AMPLIFIER

Class-C Telephony **(Carrier conditions, per tube)**

MAXIMUM RATINGS

D-C PLATE VOLTAGE	2600 MAX. VOLTS
D-C PLATE CURRENT	200 MAX. MA.
PLATE DISSIPATION	130 MAX. WATTS
GRID DISSIPATION	25 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	2000	2500	Volts
D-C Plate Current	200	200	Ma.
D-C Grid Voltage	—250	—300	Volts
D-C Grid Current	35	35	Ma.
Peak R-F Grid Input Voltage	480	535	Volts
Driving Power	17	19	Watts
Grid Dissipation	8	9	Watts
Plate Power Input	400	500	Watts
Plate Dissipation	115	125	Watts
Plate Power Output	285	375	Watts

The output figures do not allow for circuit losses.

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony
(Key-down conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	3500 MAX. VOLTS
D-C PLATE CURRENT	250 MAX. MA.
PLATE DISSIPATION	200 MAX. WATTS
GRID DISSIPATION	25 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	2000	2500	3000	3500	Volts
D-C Plate Current	250	228	222	228	Ma.
D-C Grid Voltage	—150	—180	—220	—270	Volts
D-C Grid Current	32	28	25	30	Ma.
Peak R-F Grid Input Voltage	380	400	440	505	Volts
Driving Power	12	11	11	15	Watts
Grid Dissipation	7	6	5.5	7	Watts
Plate Power Input	500	570	666	800	Watts
Plate Dissipation	200	200	200	200	Watts
Plate Power Output	300	370	466	600	Watts

The output figures do not allow for circuit losses.

(Effective 7-1-54) Copyright 1954 by Eitel-McCullough, Inc.

APPLICATION

MECHANICAL

Mounting—The 592/3-200A3 must be mounted vertically, base down or base up. Flexible connecting straps should be provided from the grid and plate terminals to the external grid and plate circuits. The tube must be protected from severe vibration and shock.

Cooling—An air-flow of approximately 15 cubic feet per minute should be directed at the bulb from a 2 inch diameter nozzle located about three inches from the center line of the tube. The center line of the nozzle should be located about two inches down from the top of the plate terminal. The incoming air temperature should not exceed 50° C. Other methods of cooling may be used provided the maximum bulb and seal temperatures are not exceeded. An 8 inch, household-type fan located about 10 inches from the tube is one alternate method. Special heat-dissipating connectors (Eimac HR-5 and HR-10, or equivalent, for grid and plate terminals respectively) should be used with this tube. These connectors help to prolong tube life by reducing the temperature of the metal-glass seals.

ELECTRICAL

Filament Voltage—For maximum tube life, the filament voltage, as measured directly at the filament pins, should be the rated value of 10.0 volts. Unavoidable variations in filament voltage must be kept within the range of 9.5 to 10.5 volts.

Bias Voltage—There is little advantage in using bias voltages in excess of those given under "Typical Operation" except in certain very specialized applications. Where bias is obtained by a grid leak, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation.

Grid Dissipation—The power dissipated by the grid of the 592/3-200A3 must not exceed 25 watts. Grid dissipation may be calculated from the following expression:

$$P_g = e_{cmp} I_c$$

where P_g = grid dissipation,

e_{cmp} = peak positive grid voltage, and

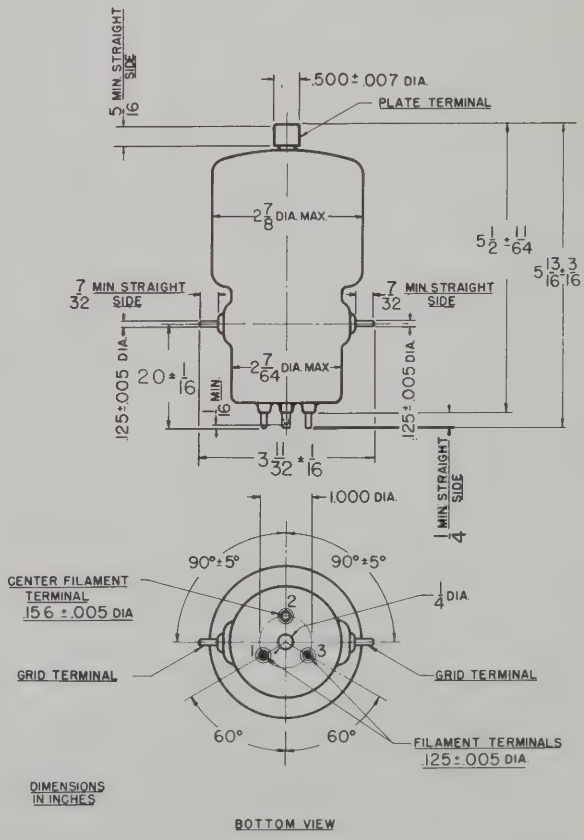
I_c = d-c grid current.

e_{cmp} may be measured by means of a suitable peak-reading voltmeter connected between filament and grid.*

Plate Voltage—Except for special applications, the plate supply voltage for the 592/3-200A3 should not exceed 3500 volts. In most cases there is little advantage in using plate-supply voltages in excess of those given under "Typical Operation" for the power output desired.

Plate Dissipation—Under normal operating conditions, the power dissipated by the plate of the 592/3-200A3 should not exceed 200 watts. At this dissipation the brightness temperature of the plate will appear a red-orange in color. The value of this color is somewhat affected by light from the filament, as well as from external sources. Plate dissipation in excess of the maximum rating is permissible for short periods of time, such as during tuning procedures.

*For suitable peak v.t.v.m. circuits see, for instance, "Vacuum Tube Ratings," **Eimac News,** January, 1945. This article is available in reprint form on request.

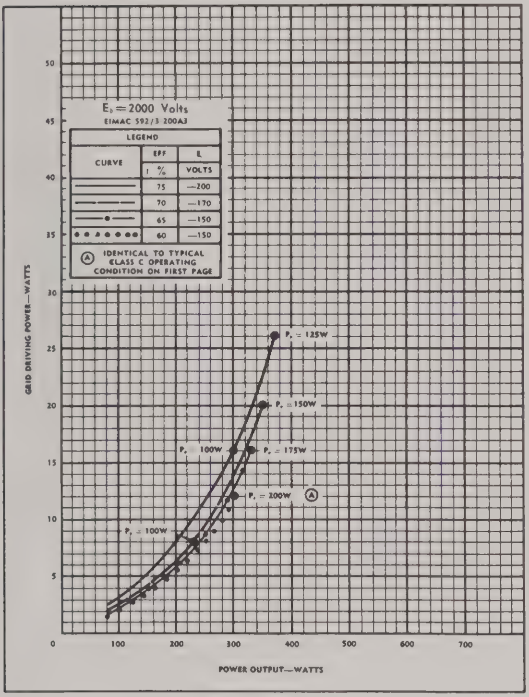


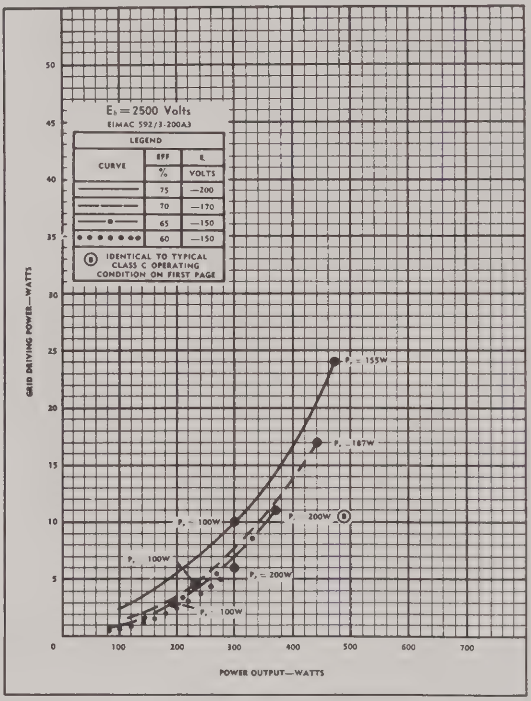
NOTE: CENTER FILAMENT TERMINAL, FILAMENT TERMINALS, AND TUBULATION ARE SO ALIGNED THAT THEY CAN BE FREELY INSERTED INTO A GAUGE ¼" THICK WITH HOLE DIA. .186", .155", AND .350" RESPECTIVELY, LOCATED ON THE TRUE CENTERS BY THE GIVEN DIMENSIONS.

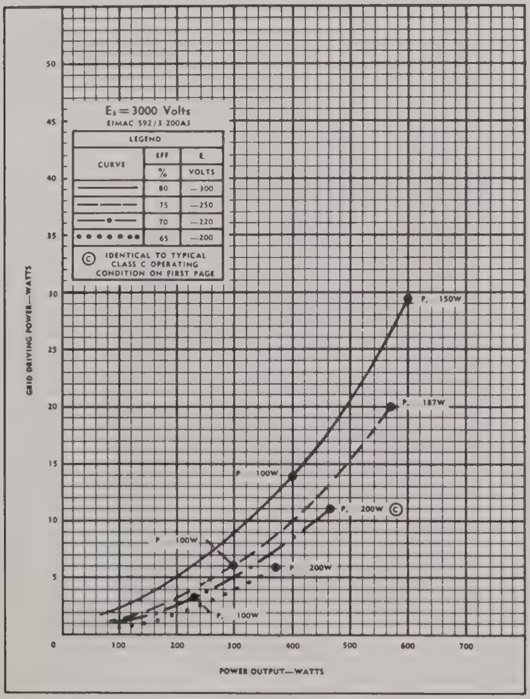
DRIVING POWER vs. POWER OUTPUT

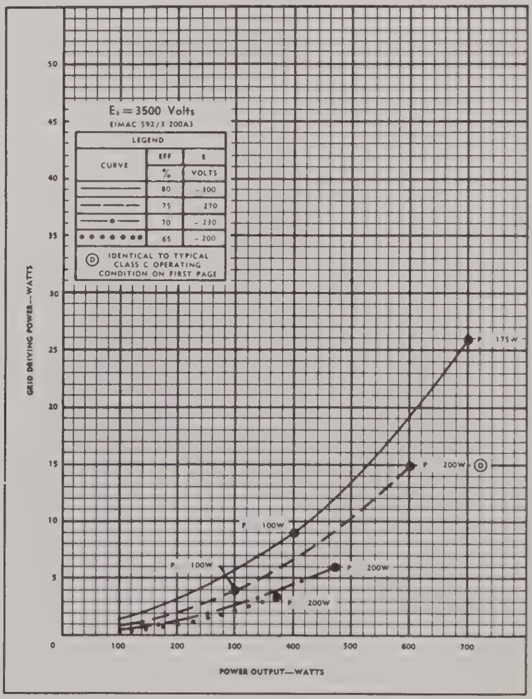
The four charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 2000, 2500, 3000 and 3500 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

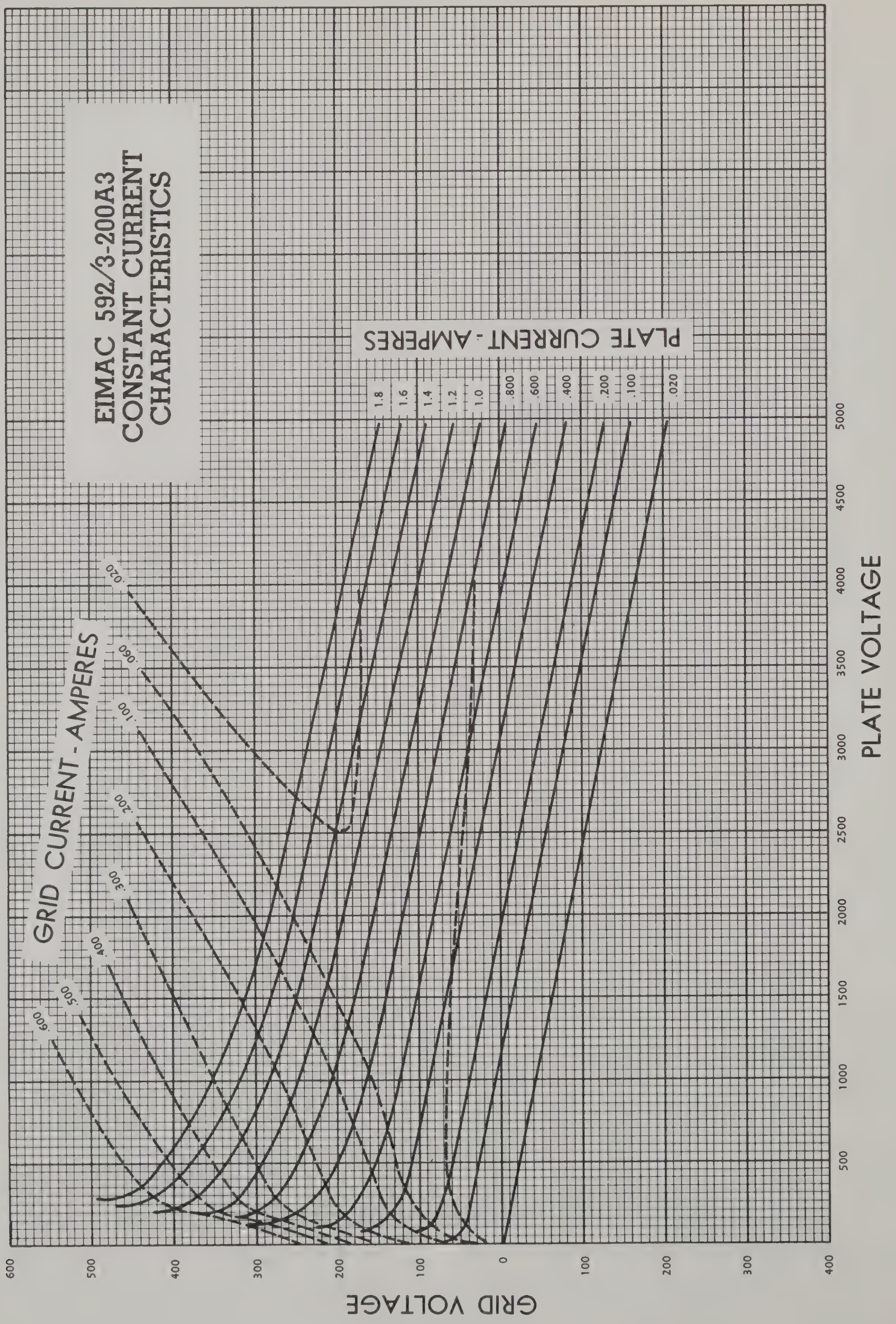
Points A, B, C, and D are identical to the typical Class C operating conditions shown on the first page under 2000, 2500, 3000 and 3500 volts respectively.











Printed in U.S.A. 845

Eimac®

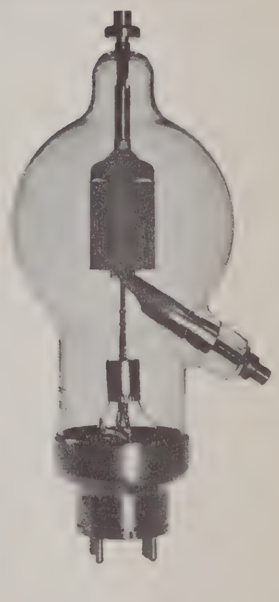
EITEL-McCULLOUGH, INC.
SAN CARLOS · CALIFORNIA

750TL

MEDIUM-MU TRIODE

•

MODULATOR
OSCILLATOR
AMPLIFIER



The Eimac 750TL is a medium-mu power triode intended for use as an amplifier, oscillator, or modulator. It has a maximum plate dissipation rating of 750 watts and a maximum plate voltage rating of 10,000 volts at frequencies up to 40 Mc. The 750TL is cooled by air-circulation and radiation.

The 750TL in class-C r-f service will deliver up to 3000 watts plate power output with 125 watts driving power. Two 750TL's in class-AB_2 modulator service will deliver up to 3500 watts maximum-signal plate power output with 46 watts driving power.

GENERAL CHARACTERISTICS

▶ ELECTRICAL

	Min.	Nom.	Max.	
Filament: Thoriated Tungsten				
Voltage	-	7.5		volts
Current	20.0		22.7	amperes
Amplification Factor	14.5		16.5	
Direct Interelectrode Capacitances:				
Grid-Plate	5.0		7.0	μμf
Grid-Filament	7.0		10.0	μμf
Plate-Filament	0.9		1.5	μμf
Transconductance (I_b=250 ma., E_b=5000 v.)		3500		μmhos
Frequency for Maximum Ratings			40	mc

MECHANICAL

Base	Special 4-pin
Connections	See outline drawing
Socket	Johnson type No. 124-214 or equivalent
Mounting Position	Vertical, base down or up
Cooling	Air-circulation and radiation
Recommended Plate and Grid Heat-Dissipating Connectors	Eimac HR-8
Maximum Overall Dimensions:	
Length	17.0 inches
Diameter	7.13 inches
Net Weight (Average)	2.9 pounds
Shipping Weight (Average)	13 pounds

AUDIO-FREQUENCY POWER AMPLIFIER OR MODULATOR

Class-AB_2 (Sinusoidal wave)

MAXIMUM RATINGS (Per tube)

D-C PLATE VOLTAGE	10,000 MAX. VOLTS
D-C PLATE CURRENT	1000 MAX. MA
PLATE DISSIPATION	750 MAX. WATTS
GRID DISSIPATION	100 MAX. WATTS

TYPICAL OPERATION (Two tubes unless otherwise specified)

D-C Plate Voltage	4000	5000	6000	volts
D-C Grid Voltage[1]	—230	—320	—390	volts
Zero-Signal D-C Plate Current	250	200	166	ma.
Max-Signal D-C Plate Current	950	860	834	ma
Effective Load, Plate-to-Plate	8270	12,300	16,300	ohms
Peak A-F Grid Voltage (per tube)	490	560	650	volts
Max-Signal Driving Power*	38	28	46	watts
Max-Signal Plate Power Input	3800	4300	5000	watts
Max-Signal Plate Power Output	2300	2800	3500	watts

[1] Adjust to stated zero-signal plate current.

RADIO-FREQUENCY POWER AMPLIFIER OR OSCILLATOR

Class-C Telegraphy or FM Telephony (Key-down conditions, per tube)

MAXIMUM RATINGS (Frequencies up to 40 Mc.)

D-C PLATE VOLTAGE	10,000 MAX. VOLTS
D-C PLATE CURRENT	1000 MAX. MA
PLATE DISSIPATION	750 MAX. WATTS
GRID DISSIPATION	100 MAX. WATTS

TYPICAL OPERATION (Frequencies up to 40 Mc.)

D-C Plate Voltage	3000	4000	5000	6000	volts
D-C Grid Voltage	—350	—450	—550	—700	volts
D-C Plate Current	713	625	600	625	ma
D-C Grid Current*	120	90	90	105	ma
Peak R-F Grid Voltage	805	885	985	1040	volts
Driving Power*	97	83	86	125	watts
Grid Dissipation*	55	40	38	50	watts
Plate Power Input	2140	2500	3000	3750	watts
Plate Power Output	1390	1750	2250	3000	watts

PLATE-MODULATED RADIO-FREQUENCY AMPLIFIER

CLASS-C TELEPHONY (Carrier conditions, per tube)

MAXIMUM RATINGS (Frequencies up to 40 Mc.)

D-C PLATE VOLTAGE	8000 MAX. VOLTS
D-C PLATE CURRENT	800 MAX. MA
PLATE DISSIPATION	500 MAX. WATTS
GRID DISSIPATION	100 MAX. WATTS

TYPICAL OPERATION (Frequencies up to 40 Mc.)

D-C Plate Voltage	3000	4000	5000	6000	volts
D-C Grid Voltage	—500	—650	—800	—950	volts
D-C Plate Current	415	400	400	415	ma
D-C Grid Current*	55	60	55	60	ma
Peak R-F Grid Voltage	830	985	1150	1330	volts
Driving Power*	45	50	60	75	watts
Grid Dissipation*	15	15	16	20	watts
Plate Power Input	1250	1600	2000	2500	watts
Plate Power Output	750	1100	1500	2000	watts

*Approximate values

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER "TYPICAL OPERATION", POSSIBLY EXCEEDING THE MAXIMUM RATINGS GIVEN FOR CW SERVICE, WRITE EITEL-McCULLOUGH, INC. FOR INFORMATON AND RECOMMENDATIONS.

(Effective 12-11-57) Copyright 1952 by Eitel-McCullough, Inc.

▶ Indicates change from sheet dated 6-2-52

APPLICATION

MECHANICAL

Mounting—The 750TL must be mounted vertically, base down or up. The plate and grid leads should be flexible. The tube must be protected from vibration and shock.

Cooling—Heat Dissipating Connectors (Eimac HR-8 or equivalent) must be used at the plate and grid terminals of the 750TL. Unobstructed circulation of air around the tube is required in sufficient quantity to prevent the seal temperatures from exceeding 225° C. Forced ventilation of compartments or equipment in which the tube is located is usually desirable. Forced movement of air across the tube seals and envelope is always beneficial, though not necessarily required.

Tube temperatures may be measured with the aid of "Tempilaq", a temperature-sensitive lacquer manufactured by the Tempil Corporation, 132 West 22nd Street, New York 11, N. Y.

ELECTRICAL

Filament Voltage—For maximum tube life the filament voltage, as measured directly at the filament pins, should be the rated value of 7.5 volts. Variations should be kept within the range of 7.5 to 7.85 volts. All four socket terminals should be used, placing two in parallel for each filament connection.

Bias Voltage—Although there is no maximum limit placed on the bias voltage which may be used with the 750TL, there is little advantage in using bias voltages in excess of those given under "Typical Operation", except in certain very specialized applications.

When grid-leak bias is used, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation, and the grid-leak resistor should be made adjustable to facilitate maintaining the bias voltage and plate current at the desired value from tube to tube.

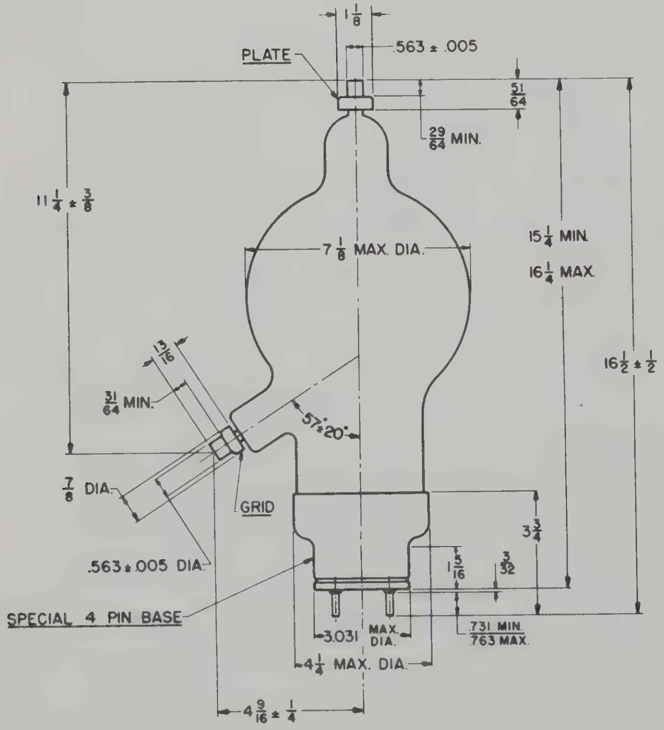
Grid Dissipation—Grid dissipation may be calculated from the following expression:

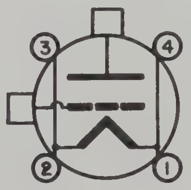
$$P_g = e_{cmp} I_c$$

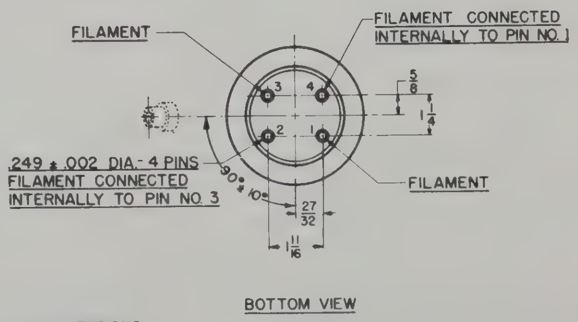
where: P_g = Grid dissipation,
e_{cmp} = Peak positive grid voltage, and
I_c = D-C grid current.

e_{cmp} may be measured by means of a suitable peak voltmeter connected between filament and grid. In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating of 100 watts under any conditions of loading.

Plate Dissipation—Under normal operating conditions, the plate dissipation of the 750TL should not be allowed to exceed the maximum rating. Plate dissipation in excess of the maximum rating is permissible for short periods of time, such as during tuning procedures.



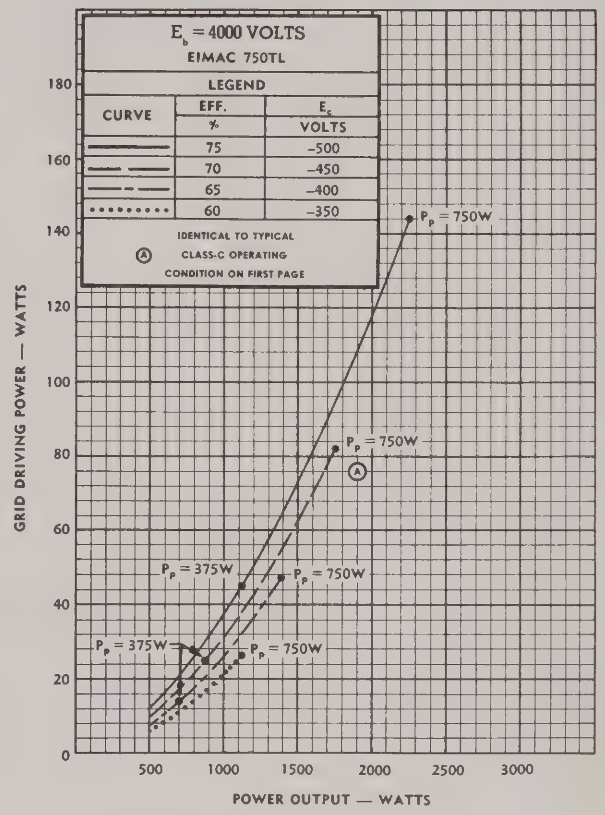


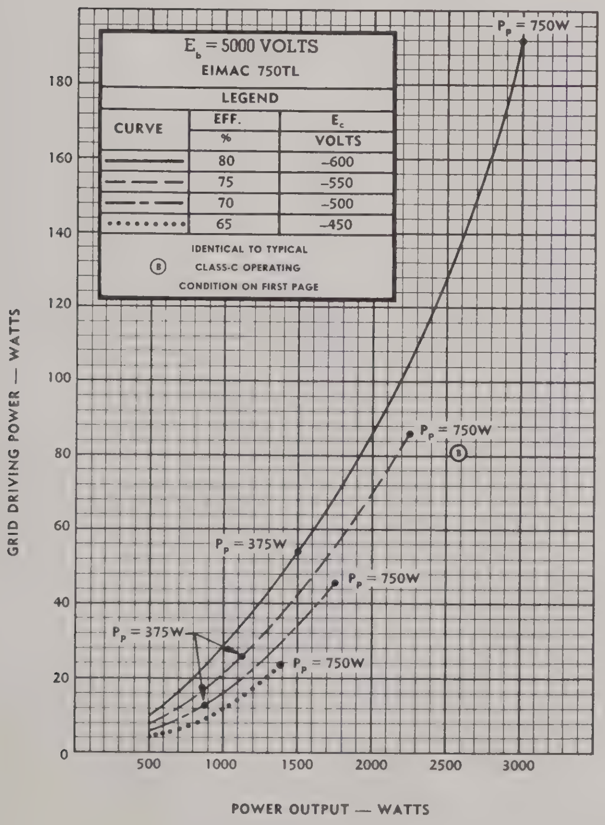

FILAMENT
FILAMENT CONNECTED INTERNALLY TO PIN NO. 1
3
4
2
1
5/8
1 1/4
.249 ± .002 DIA.- 4 PINS
FILAMENT CONNECTED INTERNALLY TO PIN NO. 3
90°± 10'
FILAMENT
27/32
1 11/16
BOTTOM VIEW

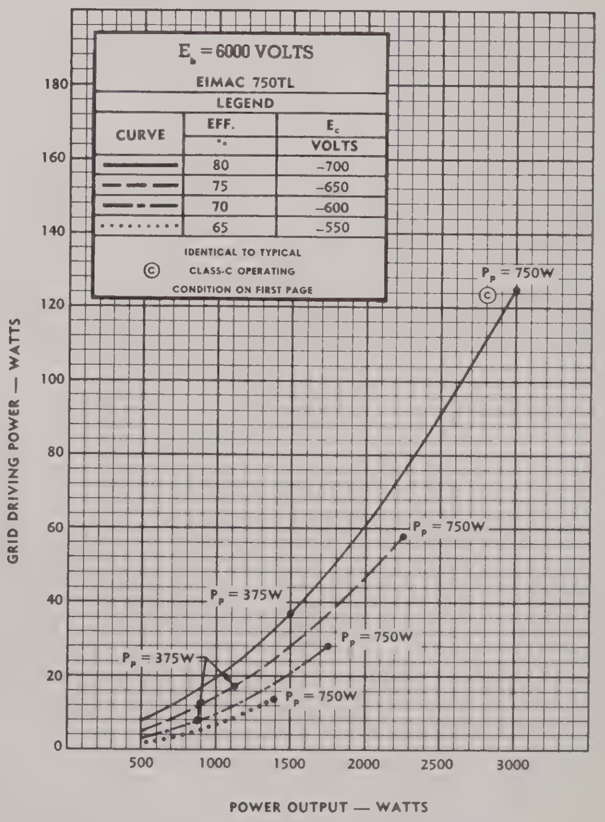
ALL DIMENSIONS IN INCHES

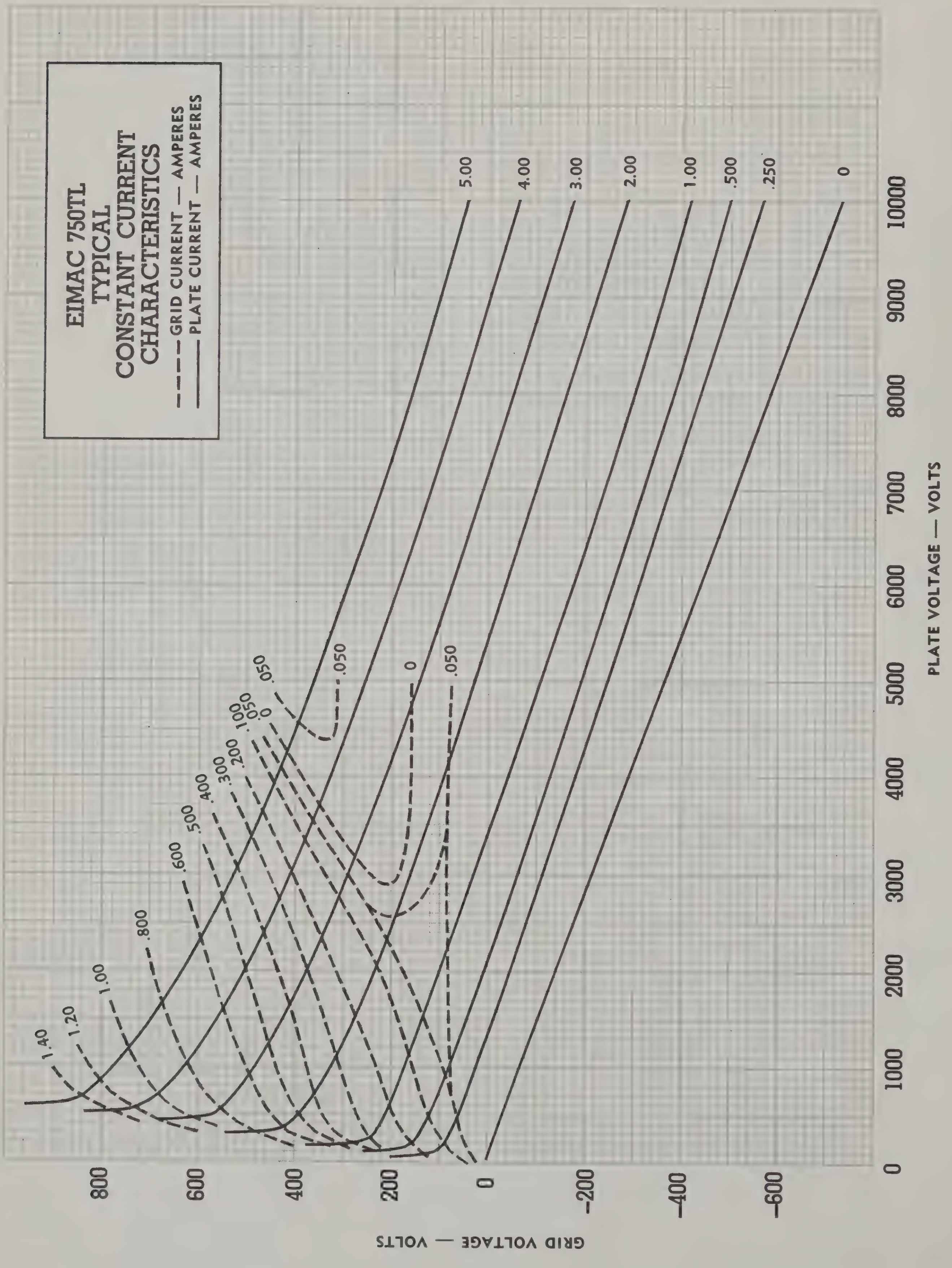
DRIVING POWER vs. POWER OUTPUT

The three charts on this page show the relationship of plate efficiency, power output and approximate grid driving power at plate voltages of 4000, 5000 and 6000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by Pp. Points A, B and C are identical to the typical Class-C operating conditions shown on the first page under 4000, 5000 and 6000 volts, respectively.









EIMAC 750TL
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS

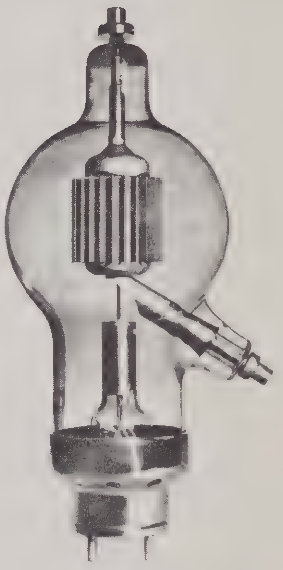
EIMAC
Division of Varian
SAN CARLOS
CALIFORNIA

1500T

MEDIUM-MU TRIODE

The EIMAC 1500T is a medium-mu power triode intended for use as an amplifier, oscillator or modulator. It has a maximum plate-dissipation rating of 1500 watts and a maximum plate voltage rating of 8000 volts at frequencies up to 40 MHz.

The 1500T in Class-C rf service will deliver up to 4500 watts plate power output with 85 watts driving power. Two 1500T's in Class-B modulator service will deliver up to 7000 watts maximum-signal plate output with 115 watts nominal driving power.



GENERAL CHARACTERISTICS[1]

ELECTRICAL

Filament: Thoriated Tungsten	
Voltage	7.5 ± 0.375 V
Current, at 7.5 volts	24.0 A
Transconductance (Average):	
I_b = 1.25A, E_b = 6000 volts	10,000 μmhos
Amplification Factor (Average):	24
Direct Interelectrode Capacitances (grounded filament)[2]	
Grid-Plate	7.2 pF
Grid-Filament	9.9 pF
Plate-Filament	1.5 pF
Frequency of Maximum Rating:	
CW	40 MHz

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1. Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.
2. In Shielded Fixture.

MECHANICAL

Maximum Overall Dimensions:	
Length	17.000 in; 431.80 mm
Diameter	7.125 in; 180.98 mm
Net Weight	36 oz; 1020 gm
Operating Position	Vertical, base up or down
Maximum Operating Temperature:	
Plate and Base Seals	225°C
Cooling	Radiation and forced air
Base	Special 4-pin
Recommended Socket	Johnson 124-214 or equivalent
Recommended Heat-Dissipating Connectors:	
Plate	HR-8
Grid	HR-8

(Effective 5-5-70) by Eimac division of Varian Printed in U.S.A.

RADIO FREQUENCY POWER AMPLIFIER OR OSCILLATOR

Class C Telegraphy or FM Telephony (Key-Down Conditions)

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE	8000	VOLTS
DC PLATE CURRENT	1.25	AMPERE
PLATE DISSIPATION	1500	WATTS
GRID DISSIPATION	125	WATTS

TYPICAL OPERATION (Frequencies to 40 MHz)

Plate Voltage	5000	6000	7000	Vdc
Grid Voltage	-375	-600	-500	Vdc
Plate Current	1.00	1.00	0.86	Adc
Grid Current	150	165	110	mAdc
Grid Dissipation[1]	59	61	30	W
Peak rf Grid Voltage[1]	850	1100	885	v
Calculated Driving Power[1]	115	160	85	W
Plate Input Power	5000	6000	6000	W
Plate Dissipation	1500	1500	1500	W
Plate Output Power	3500	4500	4500	W

1. Approximate value.

PLATE MODULATED RADIO FREQUENCY POWER AMPLIFIER GRID DRIVEN

Class C Telephony (Carrier Conditions)

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE	6500	VOLTS
DC PLATE CURRENT	1.0	AMPERE
PLATE DISSIPATION[1]	1000	WATTS
GRID DISSIPATION[2]	125	WATTS

1. Corresponds to 1500 watts at 100% sine-wave modulation.
2. Average, with or without modulation.

TYPICAL OPERATION (Frequencies to 40 MHz)

Plate Voltage	4000	5000	6000	Vdc
Grid Voltage	-450	-550	-650	Vdc
Plate Current	0.75	0.70	0.66	Adc
Grid Current	85	75	70	mAdc
Grid Dissipation[1]	30	26	25	W
Peak rf Grid Voltage[1]	860	950	1050	v
Calculated Driving Power[1]	68	67	70	W
Plate Input Power	3000	3500	4000	W
Plate Dissipation	1000	1000	1000	W
Plate Output Power	2000	2500	3000	W

1. Approximate value.

AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR

Class B, Grid Driven (Sinusoidal Wave)

ABSOLUTE MAXIMUM RATINGS (Per Tube)

DC PLATE VOLTAGE	8000	VOLTS
DC PLATE CURRENT	1.25	AMPERE
PLATE DISSIPATION	1500	WATTS
GRID DISSIPATION	125	WATTS

TYPICAL OPERATION (Two Tubes)

Plate Voltage	4000	5000	6000	Vdc
Grid Voltage[1/4]	-95	-145	-190	Vdc
Zero-Signal Plate Current	0.50	0.40	0.33	Adc
Max. Signal Plate Current	1.88	1.72	1.65	Adc
Peak af Grid Voltage[2]	485	535	570	v
Peak Driving Power[3]	190	210	230	w
Max. Signal Plate Dissipation	1500	1500	1450	W
Plate Output Power	4500	5600	7000	W
Load Resistance (plate to plate)	4150	6150	8200	Ω

1. Approximate value.
2. Per tube.
3. Nominal drive power is one-half peak power.
4. Adjust to give stated zero-signal plate current.

NOTE: TYPICAL OPERATION data are obtained by measurement or calculation from published characteristic curves. Adjustment of the rf grid voltage to obtain the specified plate current at the specified bias, and plate voltages is assumed. If this procedure is followed, there will be little variation in output power when the tube is changed, even though there may be some variation in grid current. The grid current which results when the desired plate current is obtained is incidental and varies from tube to tube. These current variations cause no difficulty so long as the circuit maintains the correct voltage in the presence of the variations in current. If grid bias is obtained principally by means of a grid resistor, the resistor must be adjustable to obtain the required bias voltage when the correct rf grid voltage is applied.

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.	
Filament: Current at 7.5 volts	22.0	25.0	A
Interelectrode Capacitances[1] (grounded filament connection)			
Grid-Plate	5.5	9.0	pF
Grid-Filament	7.5	12.5	pF
Plate-Filament	---	2.0	pF

APPLICATION

MECHANICAL

MOUNTING - The 1500T must be mounted vertically, base up or base down. Flexible leads should be provided between the grid and plate terminals and the external grid and plate circuits. The tube must be protected from vibration and shock.

COOLING - Forced-air cooling is required on the envelope and also in the base of the tube. Envelope cooling may be accomplished by locating an 8- or 10-inch fan about one foot from the tube and directing the air at the middle of the envelope.

Base cooling requires an air flow of 2½ cu. ft. per min. directed up through the bottom of the base toward the filament press. The base of the tube is provided with a 1-inch diameter hole for this purpose. If a socket is used with a 1-inch diameter matching hole and the manifold is of the same diameter, a static pressure of less than 0.1 inch of water is required at the manifold to provide the 2½ cu. ft. per min.

One type of socket provides a ¼ inch diameter pipe for the air inlet to the base. With this type of socket a static pressure of 5½ inches of water is required at the pipe to obtain the necessary 2½ cu. ft. per min. volume.

Suitable electrical interlocks should be provided to remove the plate and filament voltages in the event that the supply of cooling air is interrupted.

ELECTRICAL

FILAMENT VOLTAGE - The filament voltage, as measured directly at the filament pins, should be between 7.125 and 7.875 volts. All four socket terminals should be used by employing two for each connection to filament supply. See base diagram and outline drawing.

BIAS VOLTAGE - There is little advantage in using bias voltages in excess of those given under Typical Operation, except in certain very specialized applications. Where bias is obtained by a grid bias resistor, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation. The grid bias resistor should be adjustable to facilitate maintaining the bias voltage and plate current at the desired values from tube to tube.

GRID DISSIPATION - The power dissipated by the grid of the 1500T must not exceed 125 watts. Grid dissipation may be calculated from the following expression:

$$P_g = e_{cmp} \times I_c$$

where: P_g = Grid dissipation

e_{cmp}= Peak positive grid voltage, and

I_c = dc grid current

e_{cmp} may be measured by means of a suitable peak voltmeter connected between filament and grid. In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading.

PLATE DISSIPATION - The plate is a red-orange color when dissipating 1500 watts. Under normal operating conditions the power dissipated by the plate of the 1500T should not be allowed to exceed the maximum rating. Plate dissipation in excess of the maximum rating is permissible for short periods of time, such as during tuning procedures.

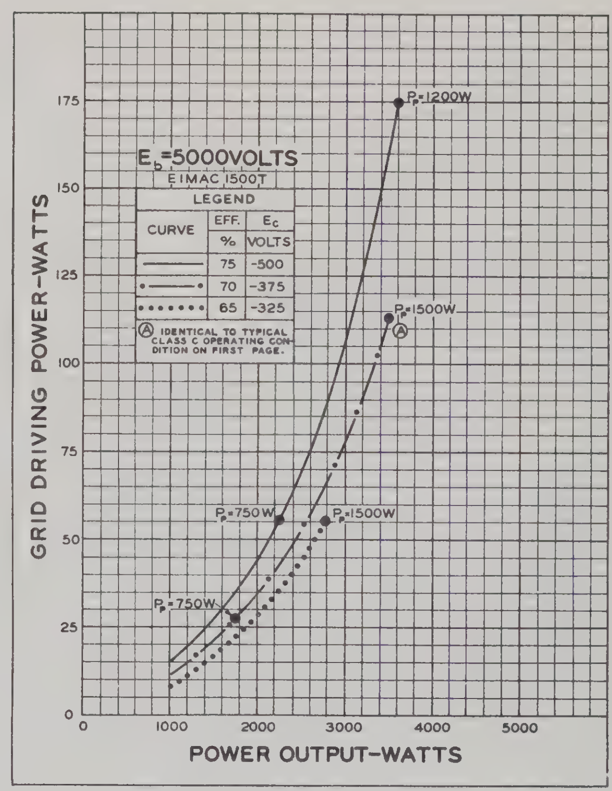
DRIVING POWER vs. POWER OUTPUT

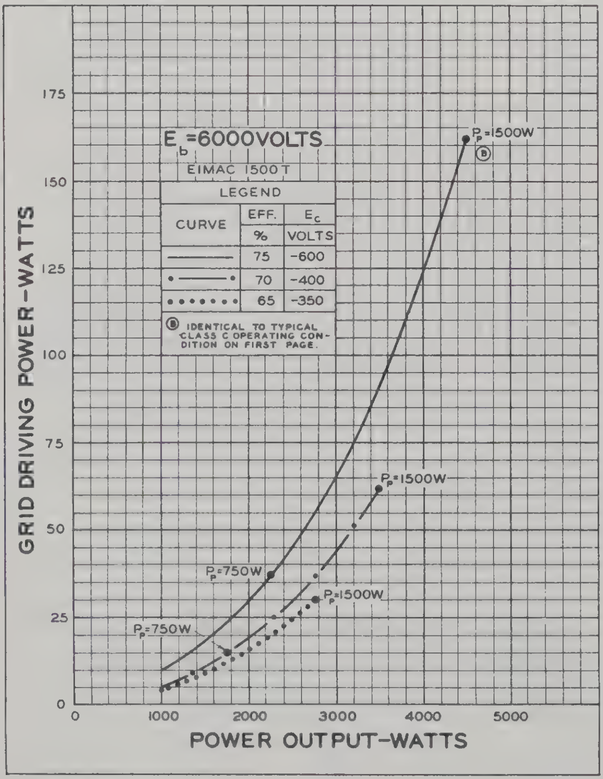
●

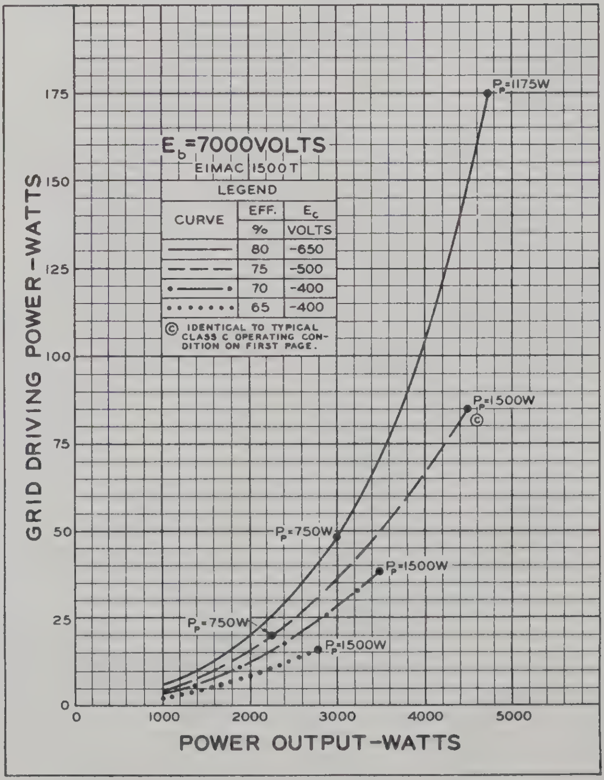
The three charts on this page show the relationship of plate efficiency, power output and approximate grid driving power at plate voltages of 5000, 6000, and 7000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by Pp.

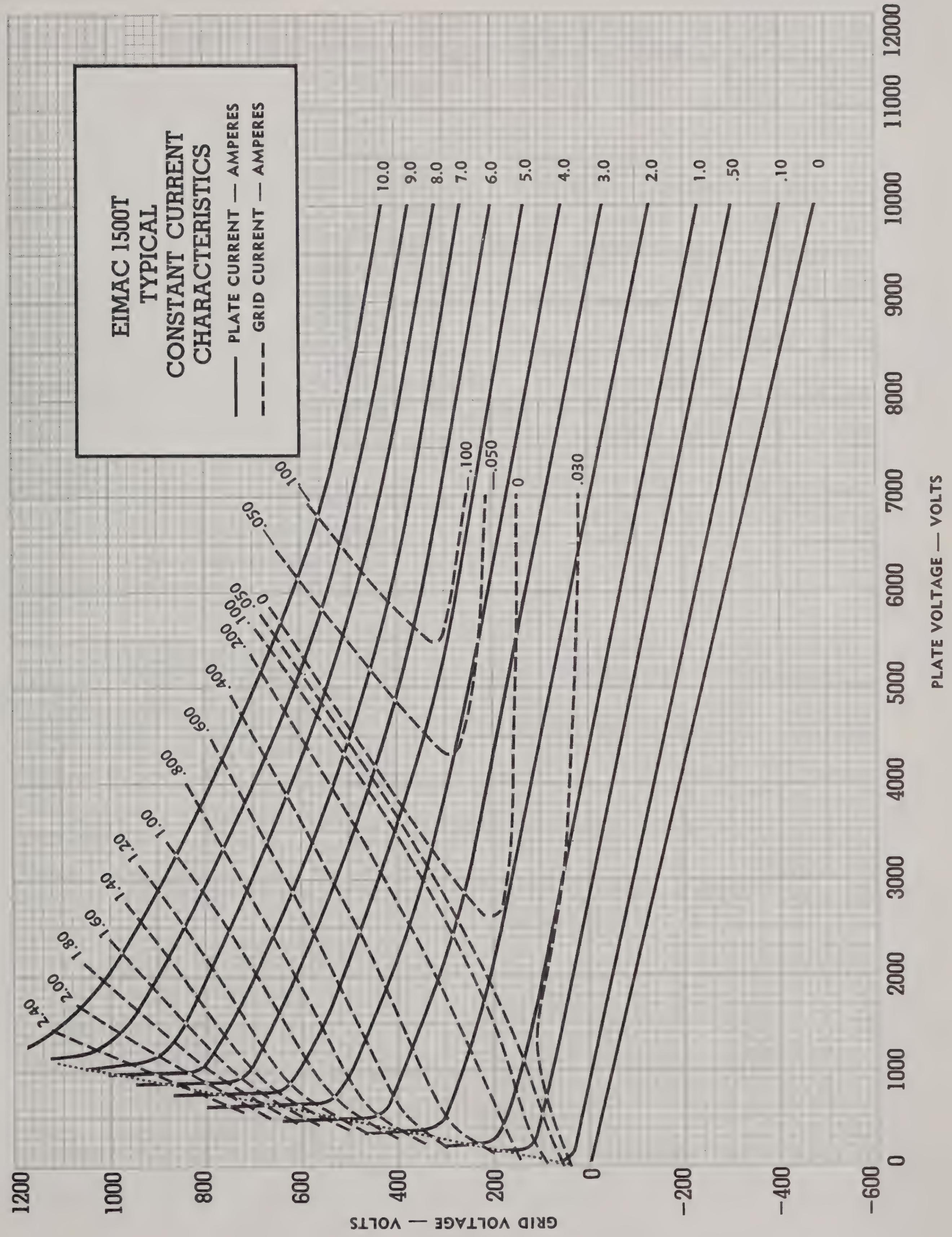
Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 5000, 6000, and 7000 volts respectively.

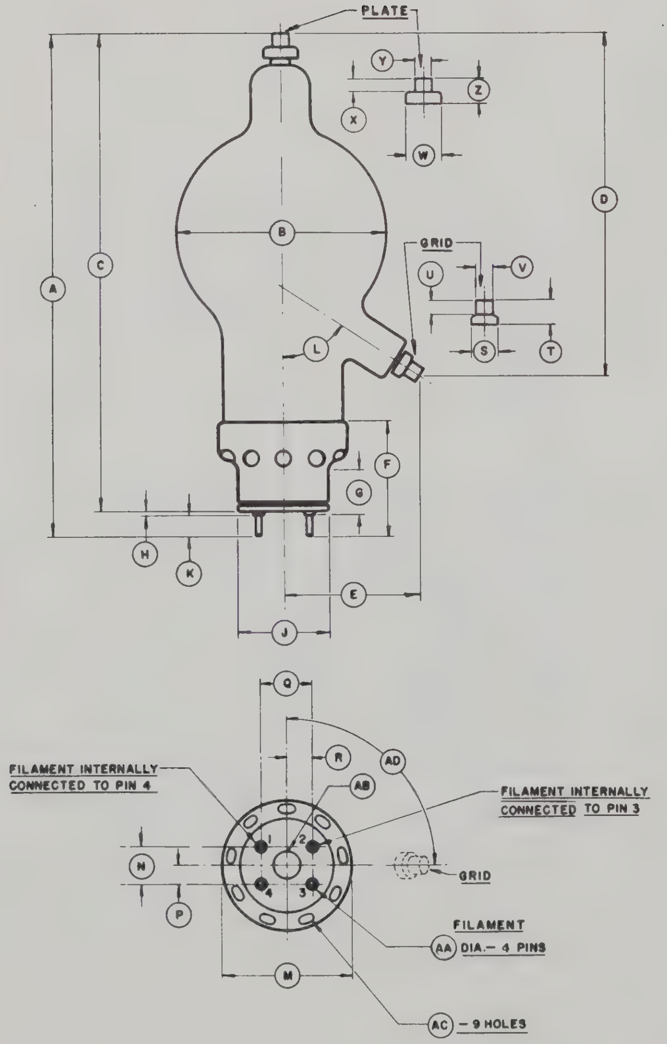
●








EIMAC 1500T
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
PLATE CURRENT — AMPERES
GRID CURRENT — AMPERES
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
.50
.10
0
2.40
2.00
1.80
1.60
1.40
1.20
1.00
.800
.600
.400
.200
.100
.050
0
.050
.100
.100
.050
0
.030
GRID VOLTAGE — VOLTS
1200
1000
800
600
400
200
0
−200
−400
−600
PLATE VOLTAGE — VOLTS
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000



DIMENSIONAL DATA

DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	16.000	17.000	– –	406.40	431.80	– –
B	– –	7.125	– –	– –	180.98	– –
C	15.250	16.250	– –	387.35	412.75	– –
D	10.875	11.625	– –	276.23	295.28	– –
E	4.313	4.813	– –	109.55	122.25	– –
F	– –	– –	3.750	– –	– –	95.25
G	– –	– –	1.313	– –	– –	33.35
H	– –	– –	0.094	– –	– –	2.39
J	– –	3.013	– –	– –	76.53	– –
K	0.731	0.763	– –	18.57	19.38	– –
L	37°	87°	– –	37°	87°	– –
M	– –	4.250	– –	– –	107.95	– –
N	– –	– –	1.250	– –	– –	31.75
P	– –	– –	0.625	– –	– –	15.88
Q	– –	– –	1.688	– –	– –	42.88
R	– –	– –	0.844	– –	– –	21.44
S	– –	– –	0.875	– –	– –	22.23
T	– –	– –	0.812	– –	– –	20.62
U	0.484	– –	– –	12.30	– –	– –
V	0.558	0.568	– –	14.18	14.43	– –
W	– –	– –	1.125	– –	– –	28.58
X	0.453	– –	– –	11.51	– –	– –
Y	0.558	0.568	– –	14.18	14.43	– –
Z	– –	– –	0.797	– –	– –	20.24
AA	0.249	0.251	– –	6.32	6.38	– –
AB	0.750 DIA	– –	– –	19.05 DIA.	– –	– –
AC	0.250 DIA	– –	– –	6.35 DIA.	– –	– –
AD	80°	100°	– –	80°	100°	– –

NOTES:
1. REF. DIMS. ARE FOR INFO. ONLY & ARE NOT REQD. FOR INSPECTION PURPOSES.

Eimac®

EITEL-McCULLOUGH, INC.
SAN CARLOS, CALIFORNIA

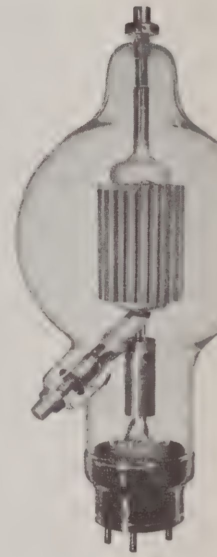
2000T

MEDIUM-MU TRIODE

•

MODULATOR
OSCILLATOR
AMPLIFIER

The 2000T is a medium-mu, high-vacuum transmitting triode intended for amplifier, oscillator and modulator service. It has a maximum plate dissipation rating of 2000 watts. Cooling of the 2000T is accomplished by radiation from the plate, which operates at a visibly red temperature at maximum dissipation, and by means of forced air circulation around the envelope and at the seals.



GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten

Voltage	10.0 volts
Current	23.5 amperes

Note: Dual connections for each filament lead are provided within the base of the tube (see basing diagram). Corresponding socket terminals must be connected in parallel to provide proper distribution of filament and R-F charging currents.

Amplification Factor (Average)	23
Direct Interelectrode Capacitances (Average)	
Grid-Plate	8.5 μμfd.
Grid-Filament	12.7 μμfd.
Plate-Filament	1.7 μμfd.
Transconductance (i_b=1.75 amp., E_b=6000 v.)	11,000 μmhos
Frequency for Maximum Ratings	40 Mc.

MECHANICAL

Base	Special 4-pin, No. 5006B
Basing	RMA type 4BD
Mounting	Vertical, base down or up
Cooling (See "Cooling" under "Application")	Radiation and forced air
Recommended Heat Dissipating Connectors:	
Plate	Eimac HR-8
Grid	Eimac HR-8
Maximum Overall Dimensions:	
Length	17.75 inches
Diameter	8.125 inches
Net weight	3.5 pounds
Shipping weight (Average)	13 pounds

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class AB₂ (Sinusoidal wave, two tubes unless otherwise specified)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	8000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT, PER TUBE	1.75 MAX. AMPS.
PLATE DISSIPATION, PER TUBE	2000 MAX. WATTS

TYPICAL OPERATION—2 TUBES

D-C Plate Voltage	4000	5000	6000	7000	Volts
D-C Grid Voltage (approx.)*	—140	—180	—230	—280	Volts
Zero-Signal D-C Plate Current	400	400	400	300	Ma.
Max-Signal D-C Plate Current	2.30	2.20	2.00	1.80	Amps
Effective Load, Plate-to-Plate	3400	5000	7000	9200	Ohms
Peak A-F Grid Input Voltage (per tube)	500	520	580	600	Volts
Max-Signal Peak Driving Power	300	280	380	350	Watts
Max-Signal Nominal Driving Power (approx.)	150	140	190	175	Watts
Max-Signal Plate Power Output	5200	7000	8000	8600	Watts

*Adjust to give stated zero-signal plate current

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony (Key-down conditions, per tube)

MAXIMUM RATINGS (Frequencies below 40 Mc.)

D-C PLATE VOLTAGE	8000 MAX. VOLTS
D-C PLATE CURRENT	1.75 MAX. AMPS.
PLATE DISSIPATION	2000 MAX. WATTS
GRID DISSIPATION	150 MAX. WATTS

TYPICAL OPERATION, PER TUBE* (Frequencies below 40 Mc.)

D-C Plate Voltage	5000	6000	7000	Volts
D-C Grid Voltage	—350	—500	—600	Volts
D-C Plate Current	1.35	1.35	1.15	Amps.
D-C Grid Current	175	165	120	Ma.
Peak R-F Grid Input Voltage	840	1000	1060	Volts
Driving Power (approx.)	140	160	115	Watts
Grid Dissipation	85	82	55	Watts
Plate Power Input	6750	8000	8000	Watts
Plate Dissipation	2000	2000	2000	Watts
Plate Power Output	4750	6000	6000	Watts

*The performance figures listed under Typical Operation are for radio frequencies up to the VHF region and are obtained by calculation from the characteristic tube curves and confirmed by direct tests. The driving power given includes power taken by the tube grid and the bias circuit. The driving power and output power do not allow for losses in the associated resonant circuits. These losses are not included because they depend principally upon the design and choice of the circuit components.

PLATE MODULATED RADIO FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS (Frequencies below 40 Mc.)

D-C PLATE VOLTAGE	6000 MAX. VOLTS
D-C PLATE CURRENT	1.4 MAX. AMPS.
PLATE DISSIPATION	1350 MAX. WATTS
GRID DISSIPATION	150 MAX. WATTS

TYPICAL OPERATION, PER TUBE* (Frequencies below 40 Mc.)

D-C Plate Voltage	4000	5000	6000	Volts
D-C Plate Current	1.25	1.20	1.13	Amps.
Total Bias Voltage	—600	—700	—800	Volts
Fixed Bias Voltage	—300	—330	—375	Volts
Grid Resistor	1500	2000	2500	Ohms
D-C Grid Current	200	185	170	Ma.
Peak R-F Grid Input Voltage (approx.)	1140	1240	1320	Volts
Driving Power (approx.)	228	230	225	Watts
Grid Dissipation	108	100	88	Watts
Plate Power Input	5000	6000	6750	Watts
Plate Dissipation	1350	1350	1350	Watts
Plate Power Output	3650	4650	5400	Watts

*The performance figures listed under Typical Operation are for radio frequencies up to the VHF region and are obtained by calculation from the characteristic tube curves and confirmed by direct tests. The driving power given includes power taken by the tube grid and the bias circuit. The driving power and output power do not allow for losses in the associated resonant circuits. These losses are not included because they depend principally upon the design and choice of the circuit components.

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APPLICATION

MECHANICAL

Mounting—The 2000T must be mounted vertically, base up or base down. Flexible connecting straps should be provided between the grid and plate terminals and the external grid and plate circuits. The tube must be protected from severe vibration and shock.

Cooling—Forced-air cooling is required on the envelope and also in the base of the tube. Envelope cooling may be accomplished by locating an ordinary 8- or 10-inch fan about one foot from the tube and directing the air at the middle of the envelope.

Base cooling requires an air flow of 2½ cu. ft. per min. directed up through the bottom of the base toward the filament press. The base of the tube is provided with a 1-inch diameter hole for this purpose. If a socket is used with a 1-inch diameter matching hole and the manifold is of the same diameter, a static pressure of less than 0.1 inch of water is required at the manifold to provide the 2½ cu. ft. per min.

One type of socket provides a ¼ inch diameter pipe for the air inlet to the base. With this type of socket a static pressure of 5½ inches of water is required at the pipe to obtain the necessary 2½ cu. ft. per min. volume.

Suitable electrical interlocks should be provided to remove the plate and filament voltages in the event that the supply of cooling air is interrupted.

ELECTRICAL

Filament Voltage—For maximum tube life the filament voltage, as measured directly at the filament pins, should be the rated value of 10 volts. Unavoidable variations in filament voltage must be kept within the range from 9.5 to 10.5 volts. All four socket terminals should be used, putting two in parallel for each filament connection.

Bias Voltage—Although there is no maximum limit on the bias voltage which may be used on the 2000T there is little advantage in using bias voltages in excess of those given under "Typical Operation," except in certain very specilaized applications. Where bias is obtained by a grid leak, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation.

Plate Voltage—The plate supply voltage for the 2000T should not exceed 8000 volts. In most cases there is little advantage in using plate-supply voltages higher than those given under "Typical Operation" for the power output desired.

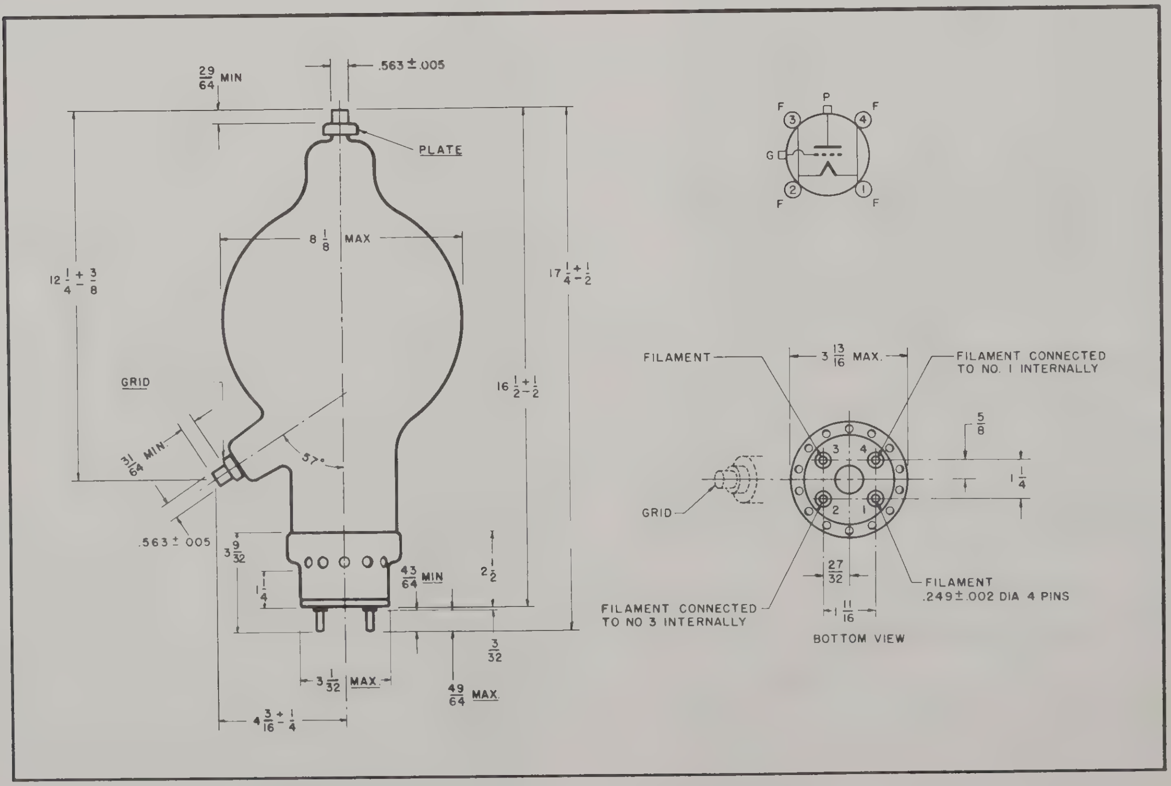
Grid Dissipation—The power dissipated by the grid of the 2000T must not exceed 150 watts. Grid dissipation may be calculated from the following expression:

$$P_g = e_{cmp} I_c$$

where P_g = Grid dissipation,
e_{cmp} = Peak positive grid voltage, and
I_c = D-c grid current.

e_{cmp} may be measured by means of a suitable peak voltmeter connected between filament and grid. In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading.

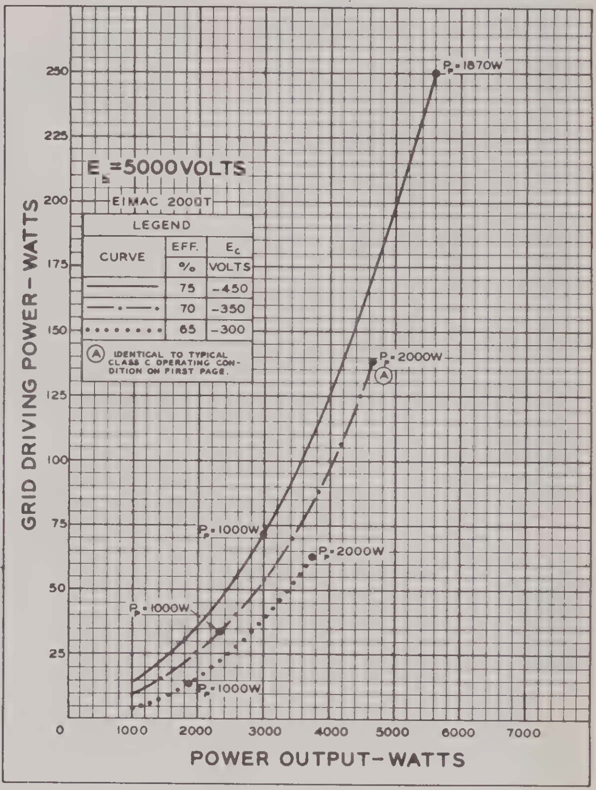
Plate Dissipation—Under normal operating conditions, the power dissipated by the plate of the 2000T should not be allowed to exceed 2000 watts. Plate dissipation in excess of the maximum rating is permissible for short periods of time, such as during tuning procedures.

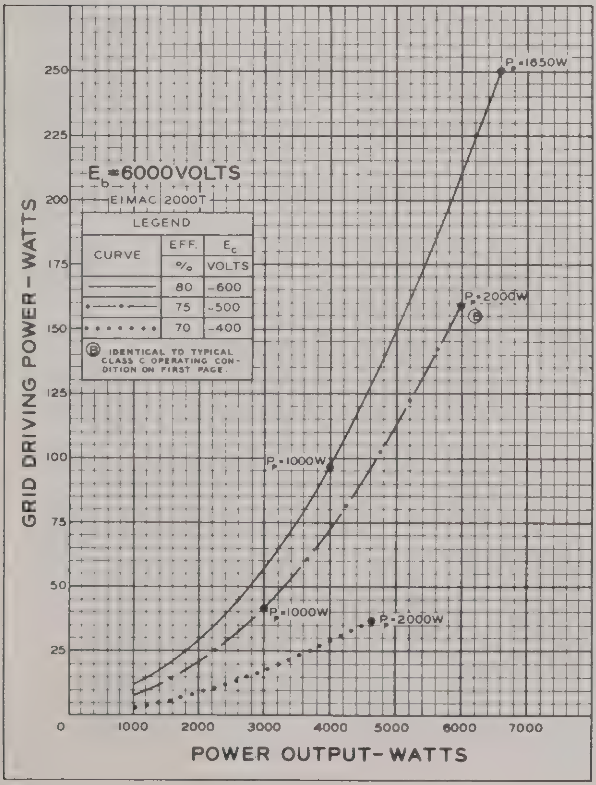


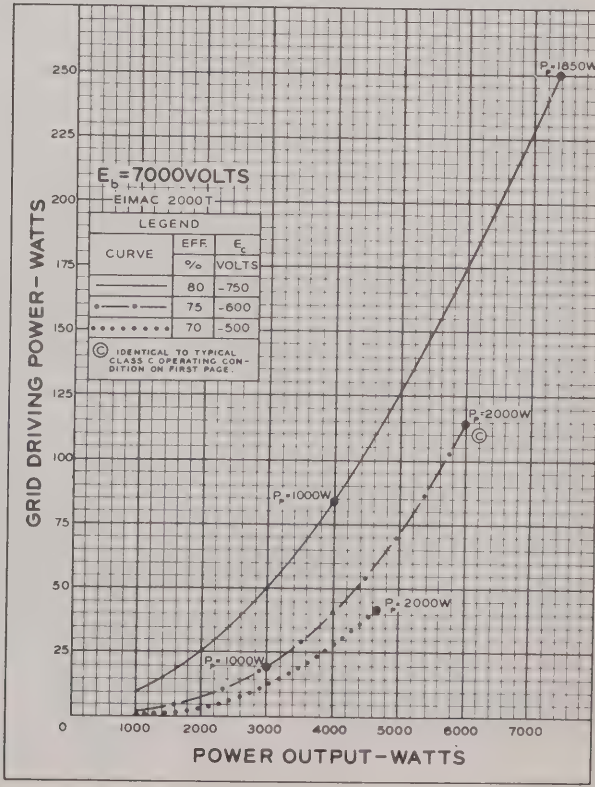
DRIVING POWER vs. POWER OUTPUT

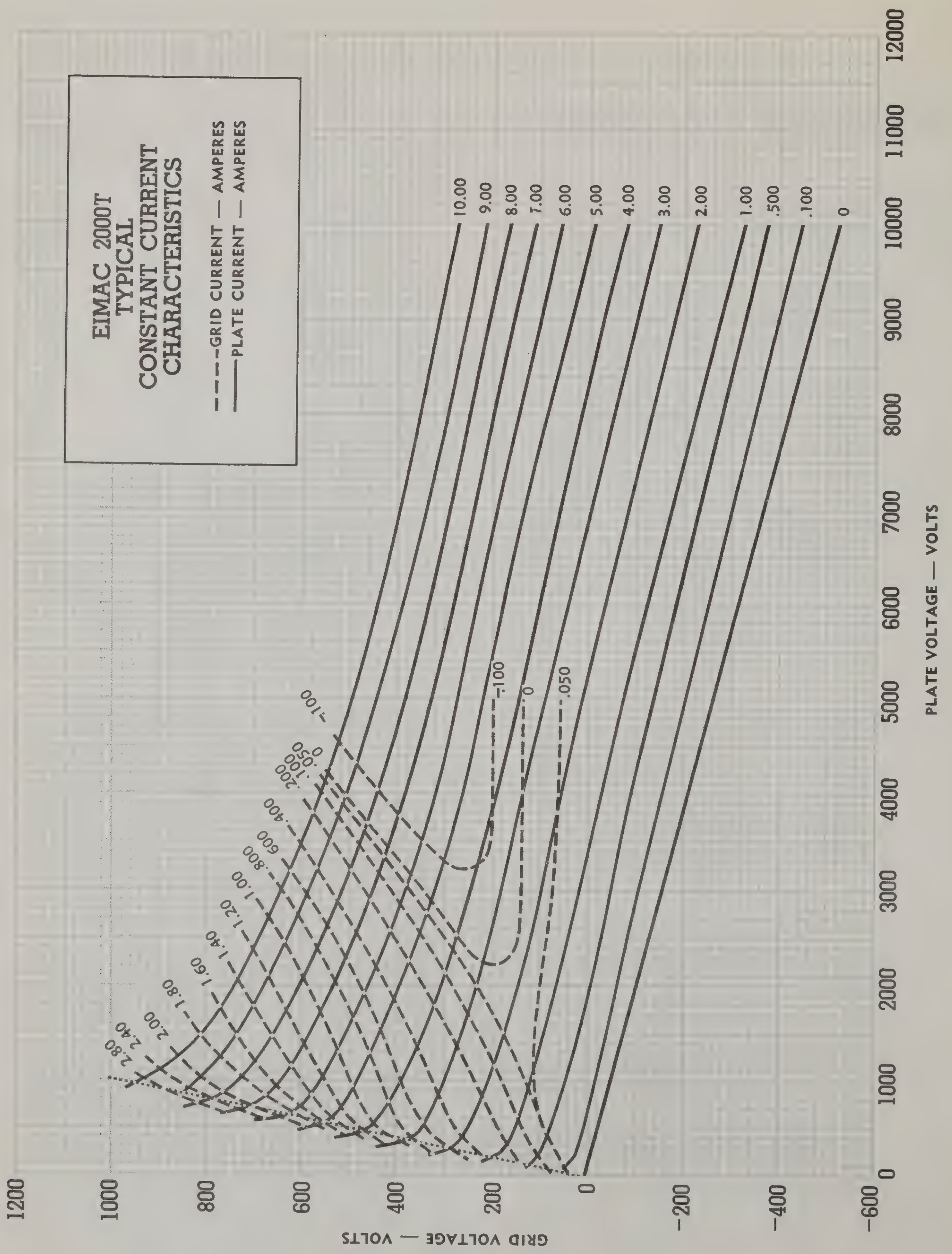
The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 5000, 6000, and 7000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 5000, 6000, and 7000 volts respectively.








EIMAC 2000T
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
– – – –GRID CURRENT — AMPERES
———PLATE CURRENT — AMPERES
GRID VOLTAGE — VOLTS
1200
1000
800
600
400
200
0
-200
-400
-600
PLATE VOLTAGE — VOLTS
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
.500
.100
0
-.100
0
.050
.100
.200
.400
.600
.800
1.00
1.20
1.40
1.60
1.80
2.00
2.40
2.80
-.100
0
.050

TECHNICAL DATA

7289
3CX100A5

PLANAR TRIODE

The EIMAC Type 7289/3CX100A5 is a rugged ceramic/metal planar triode designed for use in CW, grid- or plate-pulsed oscillator, amplifier or frequency multiplier service up to 3 GHz. The tube may also be used in pulse modulator or voltage regulator service. The 7289 is supplied with an air cooled radiator for forced air cooling.

The 7289 features high mu, high transconductance, great mechanical strength and low interelectrode capacitance.

Note: The data for the 7289/3CX100A5 also apply to the 2C39A and 2C39WA in all respects, except that filament voltage for 2C39A is 6.3 volts.

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Cathode: Oxide Coated, Unipotential		
Heater: Voltage	6.0 ± 0.3	V
Current, at 6.0 volts	1.0	A
Transconductance (Average):		
I_b = 70 mA, E_b = 600 Vdc	25	mmhos
Amplification Factor (Average)	100	
Direct Interelectrode Capacitance (grounded cathode) [2]		
Cin	6.30	pF
Cout	.035	pF
Cgp	2.00	pF
Cut-off bias[3]	-25	V max

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1. Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.

2. Capacitance values are for a cold tube as measured in a special shielded fixture. When the cathode is heated to the proper temperature, the grid-cathode capacitance will increase from the cold value by approximately 1 pF due to thermal expansion of the cathode.

3. Measured with one milliampere plate current and a plate voltage of 1 kVdc.

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Printed in U.S.A.

MECHANICAL

Maximum Overall Dimensions	
Length	2.701 in; 68.60 mm
Diameter	1.264 in; 32.11 mm
Net Weight	2.2 oz; 63 gm
Operating Position	Any
Maximum Operating Temperature:	
Ceramic/Metal Seals	250°C
Anode Core	250°C
Cooling	Forced Air
Terminals	Coaxial, special

ENVIRONMENTAL

Shock, 11 ms, non-operating	60 G
Vibration, operating, all axis, 55 to 500 Hz	10 G
Altitude, max (in suitably designed circuit)	60,000 ft.

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.	
Heater: Current at 6.0 volts	0.90	1.05	A
Cathode Warmup Time	60	---	sec.
Interelectrode Capacitance[1] (grounded cathode connection)			
Cin	5.60	7.00	pF
Cout	---	0.95	pF
Cgp	1.95	2.15	pF

1. Capacitance values for a cold tube as measured in a special shielded fixture. When the cathode is heated to the proper temperature, the grid-cathode capacitance will increase from the cold value by approximately 1 pF due to thermal expansion of the cathode.

CW RF POWER AMPLIFIER OR OSCILLATOR

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE	1000	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
Grid negative to cathode	-400	VOLTS
Grid positive to cathode	30	VOLTS
DC PLATE CURRENT	100	MILLIAMPERES
DC GRID CURRENT	50	MILLIAMPERES
AVERAGE PLATE DISSIPATION		
Forced air cooling[1]	100	WATTS
GRID DISSIPATION (Average)	2	WATTS
FREQUENCY	2.5	GHz

1. Using EIMAC radiator PN 014224.

OPERATING CONDITIONS FOR 7289 IN REPRESENTATIVE APPLICATION

GROUNDED GRID CW POWER AMPLIFIER

Frequency	500	MHz
Heater Voltage	6.0	V
DC Plate Voltage	900	Vdc
DC Grid Voltage (approx.)	-40	Vdc
DC Cathode Current	90	mAdc
DC Grid Current	25	mAdc
Drive Power (approx.)	6	W
Useful CW Power Output	40	W

GROUNDED GRID CW OSCILLATOR

Frequency	2.5	GHz
Heater Voltage	5.0	V
DC Plate Voltage	900	Vdc
DC Grid Voltage (approx.)	-20	Vdc
DC Plate Current	90	mAdc
DC Grid Current	10	mAdc
Useful CW Power Output	17	W

GRID PULSED OR PLATE PULSED AMPLIFIER OR OSCILLATOR

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE (grid pulsed)	1000	VOLTS
PEAK PULSE PLATE VOLTAGE (plate pulsed)	3500	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
Grid negative to cathode	-700	VOLTS
Grid positive to cathode	250	VOLTS
PULSE PLATE CURRENT	3.0	AMPERES
PULSE GRID CURRENT	1.8	AMPERES
AVERAGE PLATE DISSIPATION		
Forced Air Cooling[1]	100	WATTS
GRID DISSIPATION (Average)	2	WATTS
FREQUENCY	3.0	GHz
PULSE DURATION[2]	3	µs
DUTY FACTOR[2]	.0025	

Operating Conditions for 7289 in Representative Application.

PLATE PULSED OSCILLATOR

Frequency	3.0	GHz
Heater Voltage	5.8	V
Peak Plate Voltage	3500	v
Peak Video Plate Current	3.0	a
Peak Video Grid Current	1.8	a
Useful Power output (approx.)	1600	w
Pulse Duration	3	µs
Duty Factor	.0025	

1. Using EIMAC radiator PN 014224.
2. For applications using longer pulse duration and/or higher duty cycle consult the nearest Varian Electron Tube & Device Field Office, or the Product Manager, EIMAC Division of Varian, Salt Lake City, Utah.

PULSE MODULATOR AND PULSE AMPLIFIER SERVICE

ABSOLUTE MAXIMUM RATINGS

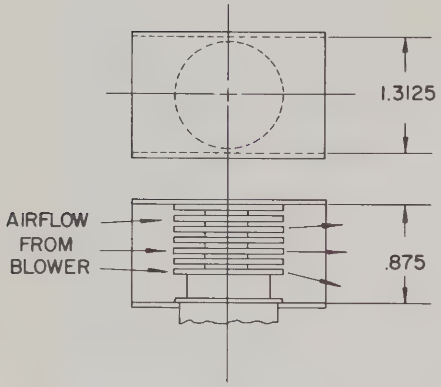
DC PLATE VOLTAGE	1000	VOLTS
PEAK PLATE VOLTAGE	1200	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
Grid negative to cathode	-700	VOLTS
Grid positive to cathode	150	VOLTS
PULSE CATHODE CURRENT	4.8	AMPERES
DC PLATE CURRENT	100	MILLIAMPERES
AVERAGE PLATE DISSIPATION		
Forced Air Cooling[1]	100	WATTS
GRID DISSIPATION (Average)	2	WATTS
PULSE DURATION[2]	3.0	µs
CUT-OFF Mu	70	
DUTY FACTOR	.0025	

1. Using EIMAC radiator PN 014224.
2. For applications using longer pulse duration and/or higher duty cycle consult the nearest Varian Electron Tube & Device Field Office, or the Product Manager, EIMAC Division of Varian, Salt Lake City, Utah.

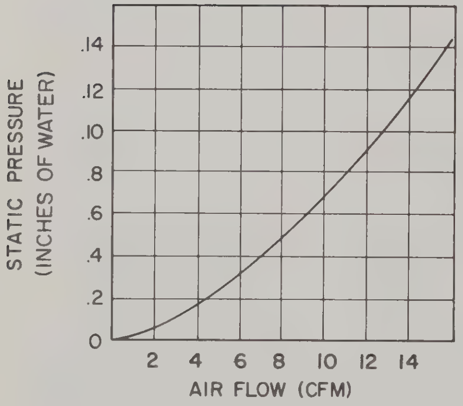
APPLICATION

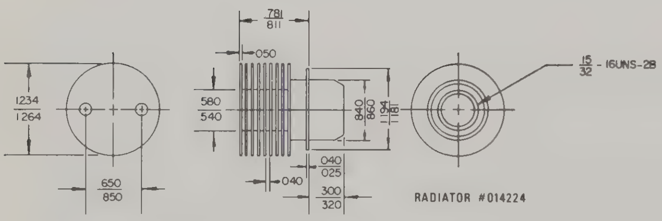
For general application information please refer to the Planar Triode Operating Instruction Sheet. The operating instructions should be consulted prior to the designing of new requirements around the above tube type. Plate dissipation of up to 150 watts is possible with the 7289 tube type when using radiator P/N 158555. If this is required the tube order should include reference to the different radiator part number. For unusual and special application consult the nearest Varian Electron Tube and Device Field Office, or the Product Manager, EIMAC Division of Varian, Salt Lake City, Utah.

AIRFLOW vs STATIC PRESSURE WITH STANDARD COWLING JAN-157

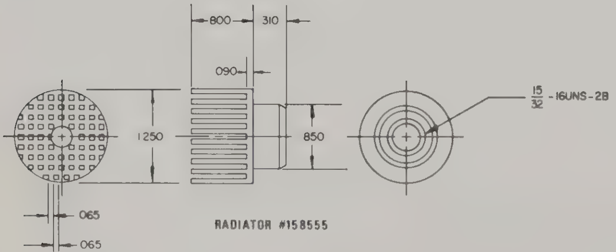


-STANDARD COWLING-



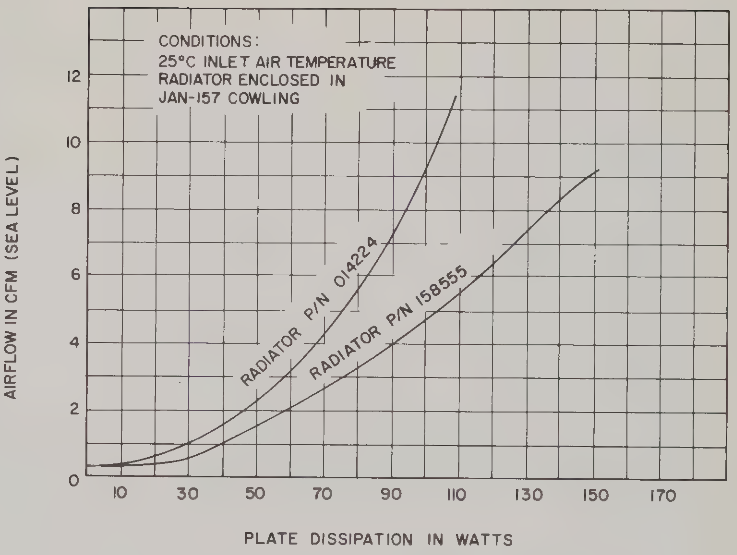


RADIATOR #014224



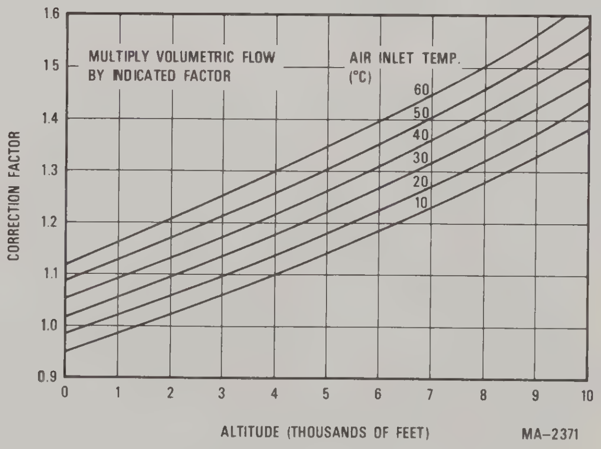
RADIATOR #158555

MAXIMUM PLATE DISSIPATION vs COOLING AIRFLOW

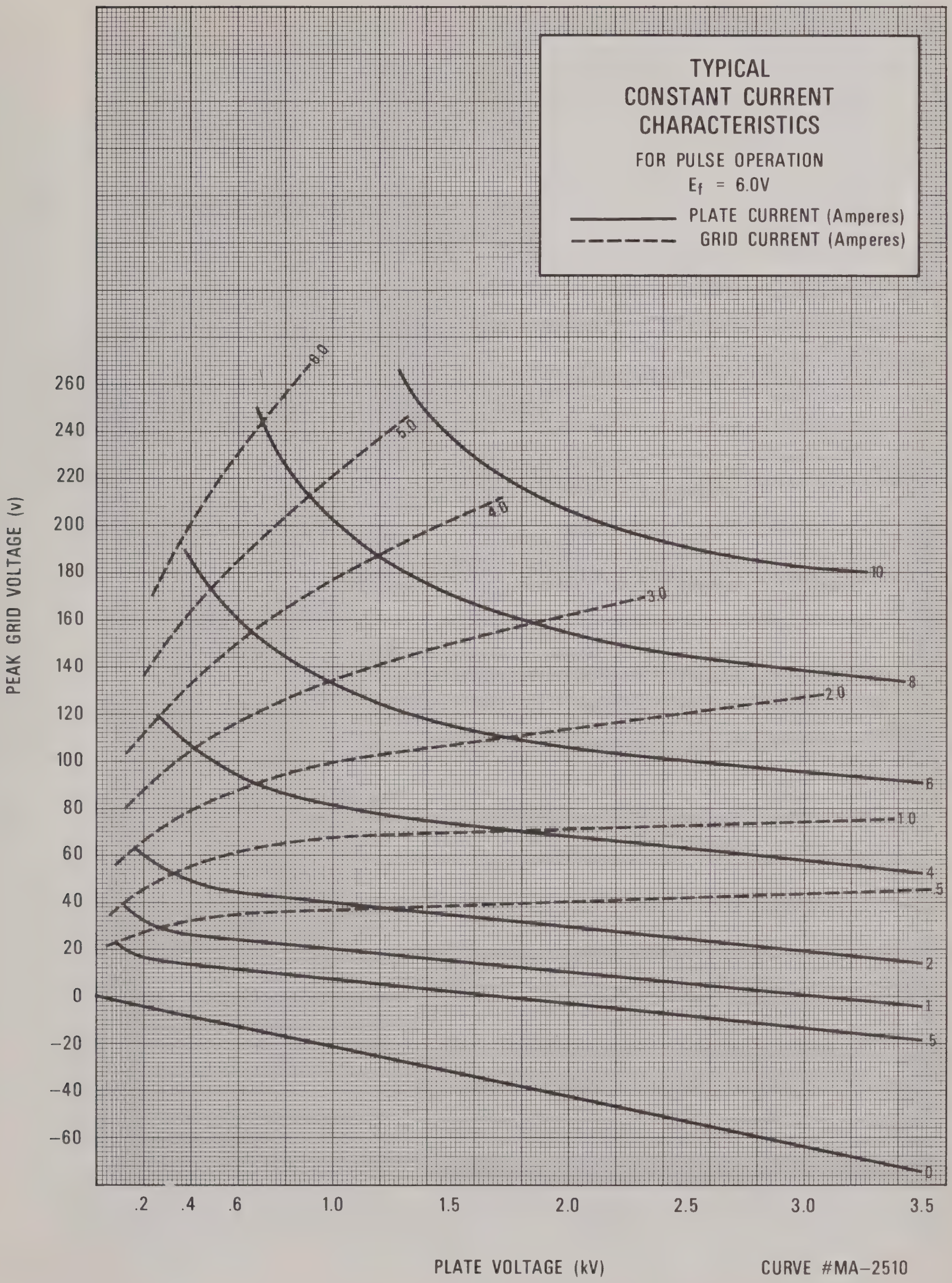


COMBINED CORRECTION FACTORS FOR INLET AIR TEMPERATURE AND ALTITUDE

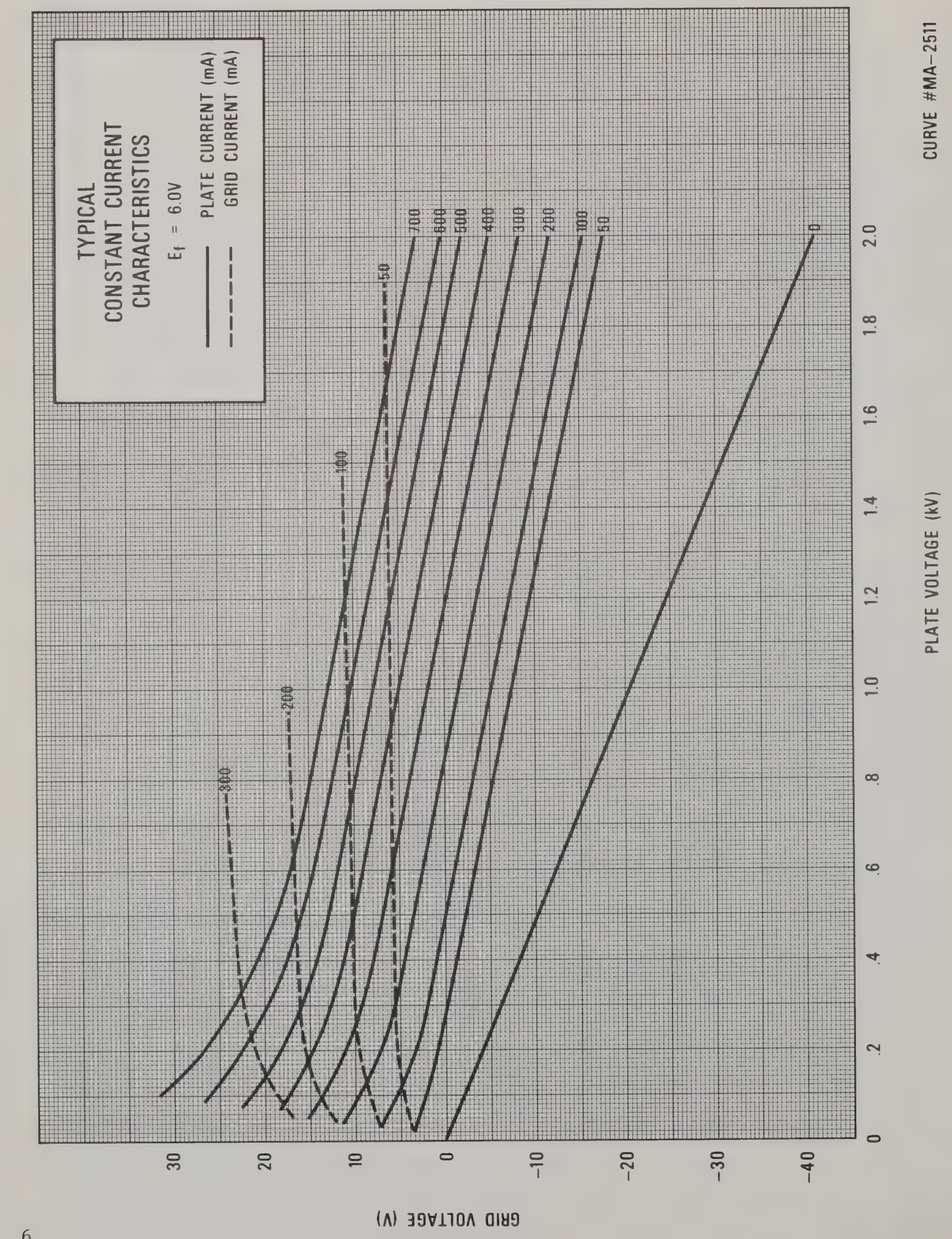
(RELATIVE TO 25°C AND SEA LEVEL)



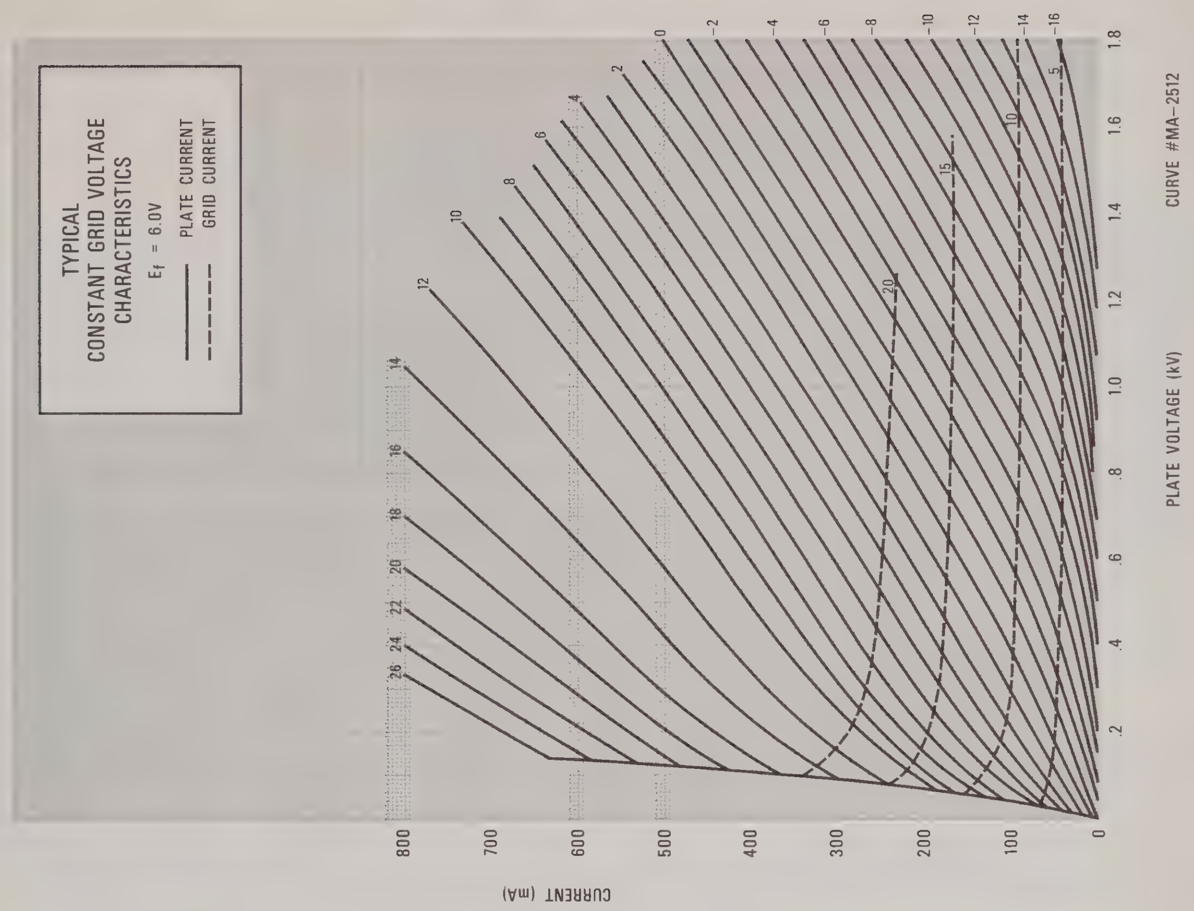
MA-2371

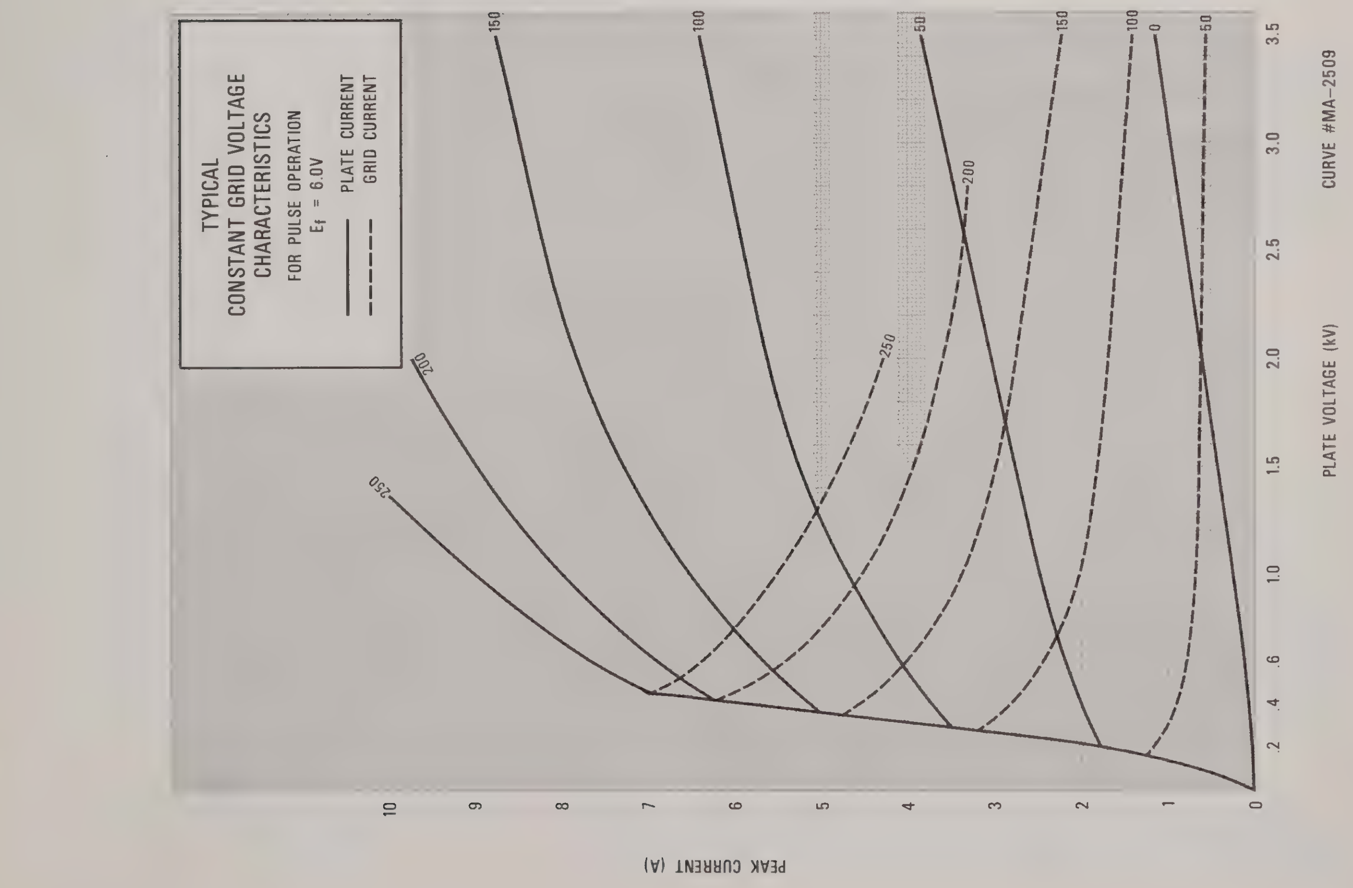


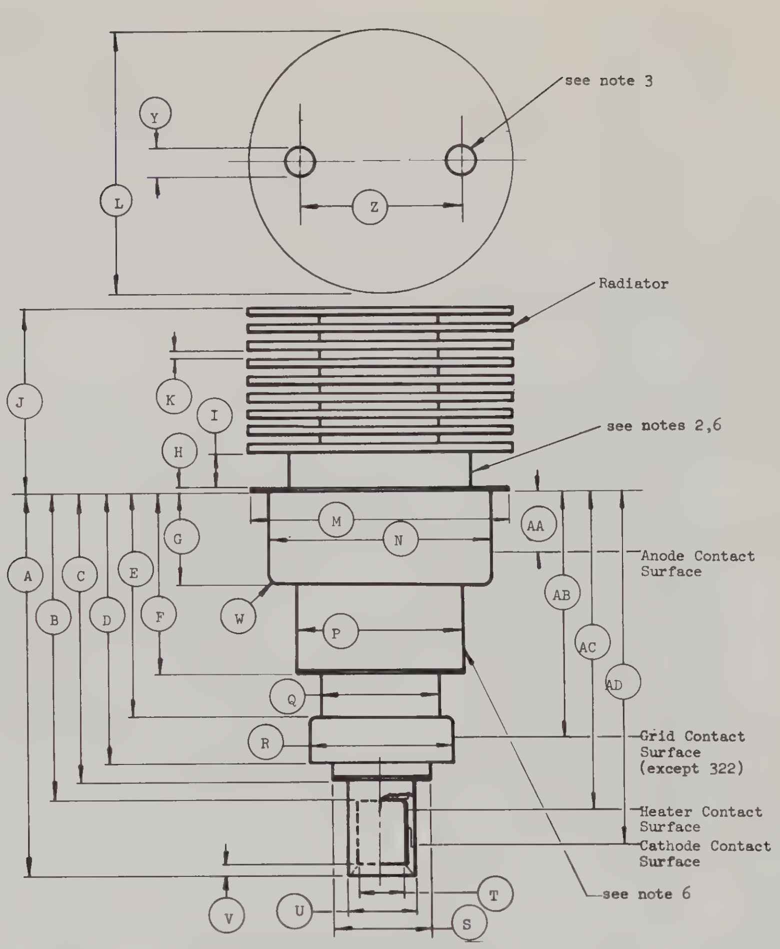
CURVE #MA–2510



CURVE #MA–2511


TYPICAL
CONSTANT GRID VOLTAGE
CHARACTERISTICS
E_f = 6.0V
PLATE CURRENT
GRID CURRENT
CURRENT (mA)
0
100
200
300
400
500
600
700
800
PLATE VOLTAGE (kV)
.2
.4
.6
.8
1.0
1.2
1.4
1.6
1.8
26
24
22
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
20
15
10
5
CURVE #MA-2512


TYPICAL
CONSTANT GRID VOLTAGE
CHARACTERISTICS
FOR PULSE OPERATION
E_f = 6.0V
PLATE CURRENT
GRID CURRENT
PEAK CURRENT (A)
0
1
2
3
4
5
6
7
8
9
10
PLATE VOLTAGE (kV)
.2
.4
.6
1.0
1.5
2.0
2.5
3.0
3.5
250
200
150
100
50
0
-50
250
200
150
100
CURVE #MA-2509



ELECTRODE CONTACT AREA				
Dim. in Inches		Dim.	Dim. in Millim.	
Min.	Max.		Min.	Max.
.035	.361	AA	.89	9.17
1.185	1.265	AB	30.10	32.14
1.534	1.728	AC	38.96	43.89
1.475	1.815	AD	37.47	46.10

DIMENSIONAL DATA						
Dim. in Inches				Dim. in Millimeters		
Min.	Max.	Ref.	Dim.	MIN.	MAX.	Ref.
1.815	1.875		A	46.10	47.62	
	1.534		B		38.96	
	1.475		C		37.46	
1.289	1.329		D	32.74	33.76	
1.085	1.135		E	27.56	28.83	
.880	.920		F	22.35	23.37	
.462	.477		G	11.73	12.12	
	.040		H		1.02	
.125	.185		I	3.18	4.70	
.766	.826		J	19.46	20.98	
.025	.046		K	.64	1.17	
1.234	1.264		L	31.34	32.11	
1.180	1.195		M	29.97	30.35	
1.025	1.035		N	26.04	26.29	
.752	.792		P	19.20	20.12	
.541	.561		Q	13.74	14.25	
.655	.665		R	16.64	16.89	
	.545		S		.13.84	
.213	.223		T	5.41	5.66	
.315	.325		U	8.00	8.26	
	.100		W		2.54	
.105	.145		Y	2.67	3.68	
.650	.850		Z	16.51	21.59	
	.086		V		2.18	

NOTES:

1. Metric equivalents to the nearest .01 mm, are given for general information only & are based on 1 inch = 25.4 mm.
2. This surface shall be used to measure Anode shank temperatire.
3. Holes for extractor thru top fin only.
4. Eccentricity of contact surfaces shall be gaged from center line of reference & shall be as follows:

Contact Surface	TIR Max.	Reference
Anode	.020	Cathode
Grid	.020	Cathode
Heater	.012	Cathode

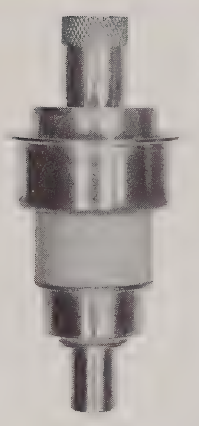
5. Dias. N,R,T & U shall apply throughout entire lenght as defined by dims. AA,AB,AC & AD respectively.
6. This surface shall not be used for clamping or locating.
7. Electrode Contact dims. are given for socket design purposes & are not intended for inspection purposes.

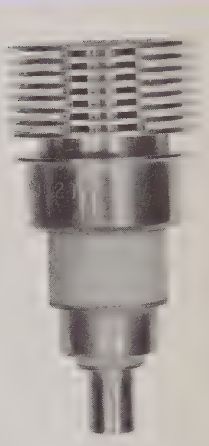
Eimac®

TECHNICAL DATA

7815
7815R

PLANAR TRIODES


7815


7815R

The EIMAC 7815 and 7815R are rugged ceramic/metal planar triodes designed for use in CW, grid- or plate-pulsed oscillator, amplifier or frequency multiplier service up to 3 GHz. The tubes may also be used in pulse modulator or voltage regulator service. The 7815R is normally supplied with an air cooled radiator for forced air cooling, while the 7815 is supplied without radiator and is intended for conduction-convection cooling as found in many pulsed type applications. Except for the plate dissipation ratings and outline, the characteristics of both tube types are identical.

The 7815 and 7815R feature high mu, high transconductance, great mechanical strength and low interelectrode capacitances, as well as high current capability and increased grid-anode insulator length. Both tubes have an arc-resistant, extended interface cathode, well proven in airline applications, assuring reliable and long life operation under adverse conditions.

Note: This data sheet also covers the 3CPN10A5 (same as 7815) and 3CPX100A5 (same as 7815R).

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Cathode: Oxide Coated, Unipotential		
Heater: Voltage	6.0 ± 0.3	V
Current, at 6.0 volts	1.00	A
Transconductance (Average):		
$I_b = 70$ mAdc, ($E_b = 600$ Vdc)	25	mmhos
Amplification Factor (Average)	100	
Direct Interelectrode Capacitance (grounded cathode)[2], without heater voltage:		
Cin	6.3	pF
Cgp	1.98	pF
Cout	0.035	pF
Cut-off Bias[3] (maximum)	-25	V

---

1. Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.
2. Capacitance values are for a cold tube as measured in a special shielded fixture. When the cathode is heated to the proper temperature, the grid-cathode capacitance will increase from the cold value by approximately 1 pF due to thermal expansion of the cathode.
3. Measured with one milliampere plate current and a plate voltage of 1 kVdc.

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MECHANICAL

Maximum Overall Dimensions:	
Length	2.701 in; 68.60 mm
Diameter (7815)	1.195 in; 30.35 mm
Diameter (7815R)	1.264 in; 32.11 mm
Net Weight (7815)	1.8 oz; 48 gm
Net Weight (7815R)	2.2 oz; 63 gm
Operating Position	Any
Maximum Operating Temperature:	
Ceramic/Metal Seals	250°C
Anode Core	250°C
Cooling (7815)	Conduction and Convection
Cooling (7815R)	Forced Air
Terminals	Coaxial, special

ENVIRONMENTAL

Shock, 11 ms, non-operating	60 G
Vibration, operating, all axes 55 to 500 Hz	10 G
Altitude, max (in a suitably designed circuit)	70,000 ft.

CW RF POWER AMPLIFIER OR OSCILLATOR

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE	2500	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
Grid negative to cathode	-400	VOLTS
Grid positive to cathode	30	VOLTS
DC PLATE CURRENT	100	MILLIAMPERES
DC GRID CURRENT	50	MILLIAMPERES
AVERAGE PLATE DISSIPATION		
Conduction and Convection (7815)	10	WATTS
Forced Air Cooling (7815R)	100	WATTS
GRID DISSIPATION (Average)	2	WATTS
FREQUENCY	2.5	GHz

OPERATING CONDITIONS FOR 7815 AND 7815R IN REPRESENTATIVE APPLICATION

Grounded Grid CW Power Amplifier

Frequency	500	MHz
Heater Voltage	6.0	V
DC Plate Voltage	900	Vdc
DC Grid Voltage (approx)	-40	Vdc
DC Cathode Current	90	mAdc
DC Grid Current	25	mAdc
Drive Power (approx)	6	W
Useful CW Power Output	40	W

Grounded Grid CW Oscillator

Frequency	2.5	GHz
Heater Voltage	5.0	V
DC Plate Voltage	900	Vdc
DC Grid Voltage (approx)	-20	Vdc
DC Plate Current	90	mAdc
DC Grid Current	10	mAdc
Useful CW Power Output	17	W

GRID PULSED OR PLATE PULSED AMPLIFIER OR OSCILLATOR

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE (GRID PULSED)	2500	VOLTS
PEAK PULSE PLATE VOLTAGE (PLATE PULSED)	3500	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
Grid negative to cathode	-700	VOLTS
Grid positive to cathode	250	VOLTS
PULSE PLATE CURRENT	3.0	AMPERES
PULSE GRID CURRENT	1.8	AMPERES
AVERAGE PLATE DISSIPATION		
Conduction and Convection (7815)	10	WATTS
Forced Air Cooling (7815R)	100	WATTS
GRID DISSIPATION (Average)	2	WATTS
FREQUENCY	3.0	GHz
PULSE DURATION[1]	6	μs
DUTY FACTOR[1]	.0033	

OPERATING CONDITIONS FOR 7815 AND 7815R IN REPRESENTATIVE APPLICATION

Grid Pulsed Amplifier

Frequency	1.1	GHz
Heater Voltage	6.0	V
DC Plate Voltage	2200	Vdc
DC Grid Voltage	-45	Vdc
Peak Video Plate Current	1.9	a
Peak Video Grid Current	1.1	a
Pulse Drive Power (approx)	400	w
Useful Power Output (approx)	2000	w
Pulse Duration	3	μs
Duty Factor	.002	

Plate Pulsed Oscillator

Frequency	3.0	GHz
Heater Voltage	5.8	V
Peak Plate Voltage	3500	v
Peak Video Plate Current	3.0	a
Peak Video Grid Current	1.8	a
Useful Power Output (approx)	1600	w
Pulse Duration	3	μs
Duty Factor	.0025	

1. For application requiring longer pulse duration and/or higher duty cycle consult the nearest Varian Electron Tube & Device Field Office, or the Product Manager, EIMAC Division of Varian, Salt Lake City, Utah.

PULSE MODULATOR OR PULSE AMPLIFIER SERVICE

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE	2500	VOLTS
PEAK PLATE VOLTAGE	3500	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
Grid negative to cathode	-700	VOLTS
Grid positive to cathode	150	VOLTS
PULSE CATHODE CURRENT	4.8	AMPERES
DC PLATE CURRENT	100	MILLIAMPERES
AVERAGE PLATE DISSIPATION		
Conduction and Convection (7815)	10	WATTS
Forced Air Cooling (7815R)	100	WATTS
GRID DISSIPATION (Average)	2	WATTS
PULSE DURATION [1]	6	μs
DUTY FACTOR [1]	.0033	
CUT-OFF MU	70	

1. For application requiring long pulse duration and/or higher duty cycle consult the nearest Varian Electron Tube & Device Field Office, or the Product Manager, EIMAC Division of Varian, Salt Lake City, Utah.

RANGE VALUES FOR EQUIPMENT DESIGN

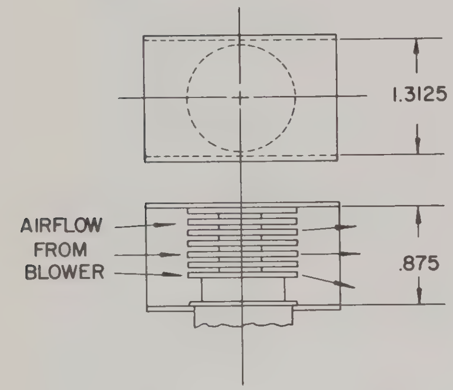
	Min.	Max.	
Heater: Current at 6.0 volts	0.90	1.05	A
Cathode Heating Time	60	---	sec.
Interelectrode Capacitances[1] (grounded cathode connection)			
Cin	5.60	7.00	pF
Cout	---	0.035	pF
Cgp	1.85	2.10	pF

1. Capacitance values for a cold tube as measured in a special shielded fixture. When the cathode is heated to the proper temperature, the grid-cathode capacitance will increase from the cold value by approximately 1 pF due to thermal expansion of the cathode.

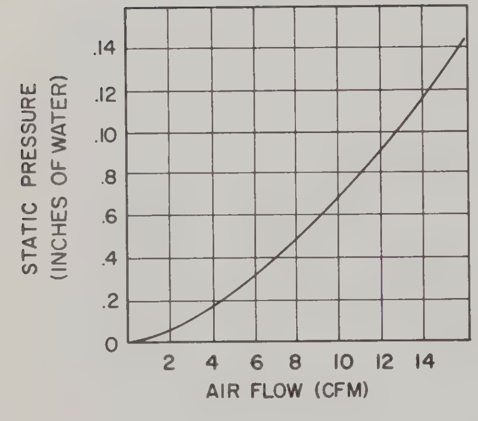
APPLICATION

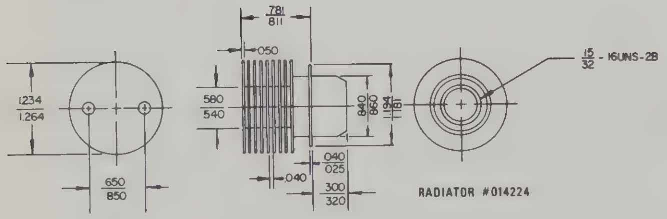
For general application information please refer to the Planar Triode Operating Instruction Sheet. The operating instructions should be consulted prior to the designing of new requirements around the above tube types. Plate dissipation of up to 150 watts is possible with the 7815/7815R tube type when using radiator P/N 158555. If this is required the tube order should include a reference the different radiator part number. For unusual and special application consult the nearest Varian Electron Tube and Device Field Office, or the Product Manager, EIMAC Division of Varian, Salt Lake, City, Utah.

AIRFLOW vs STATIC PRESSURE WITH STANDARD COWLING JAN-157

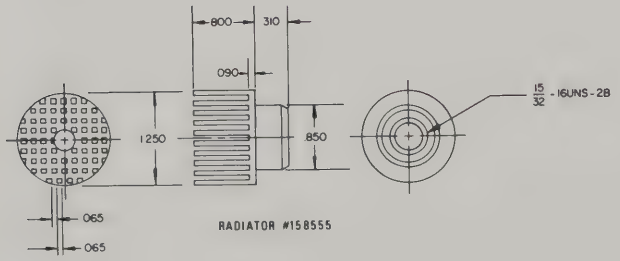


-STANDARD COWLING-



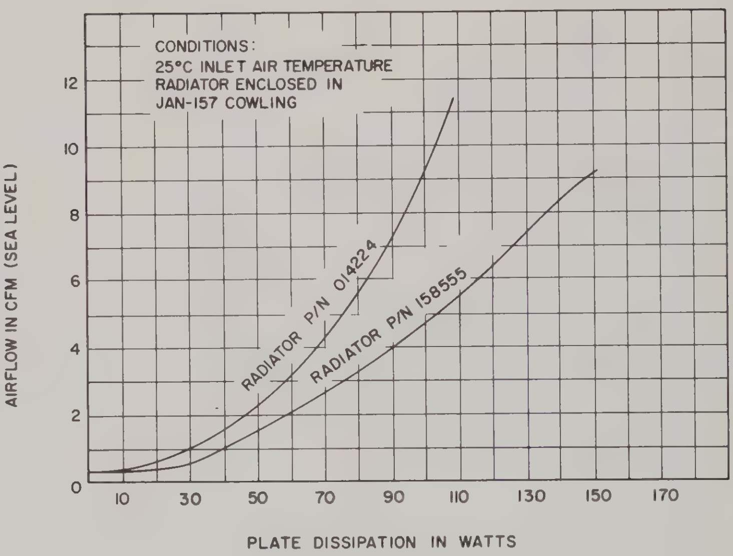


RADIATOR #014224



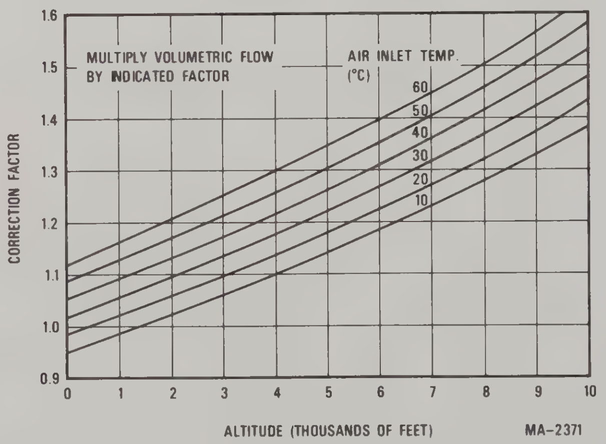
RADIATOR #158555

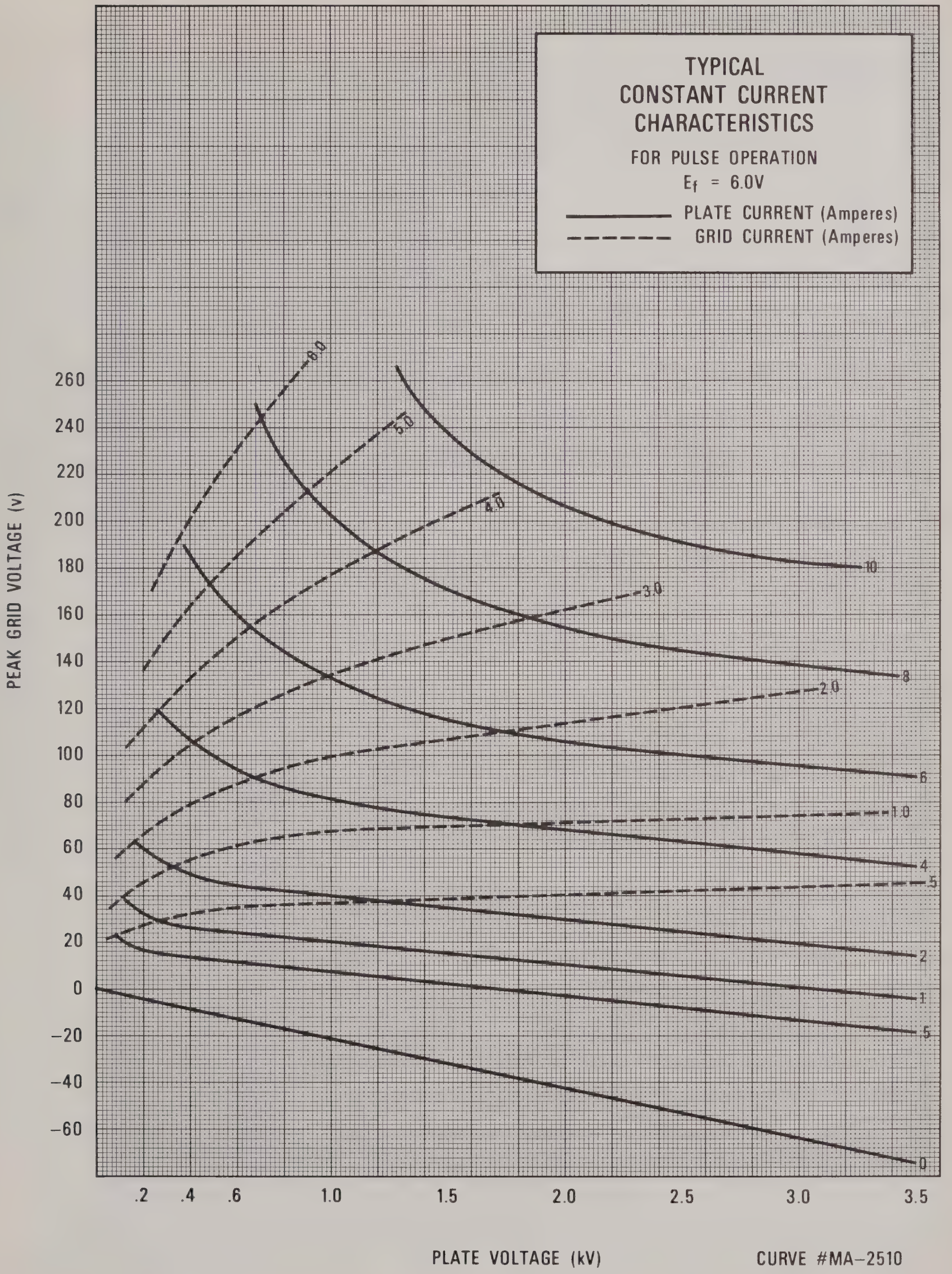
MAXIMUM PLATE DISSIPATION vs COOLING AIRFLOW

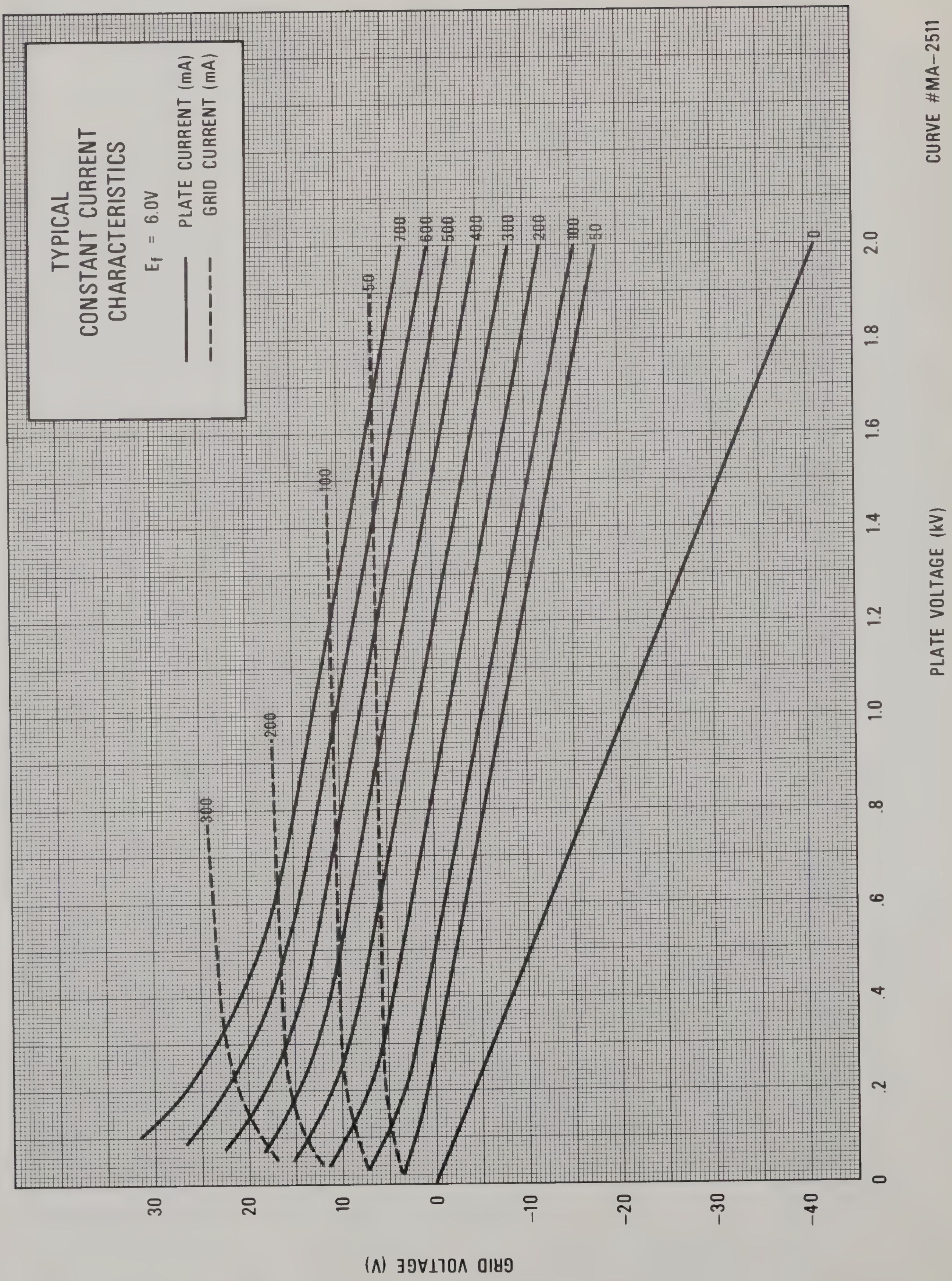


COMBINED CORRECTION FACTORS FOR INLET AIR TEMPERATURE AND ALTITUDE

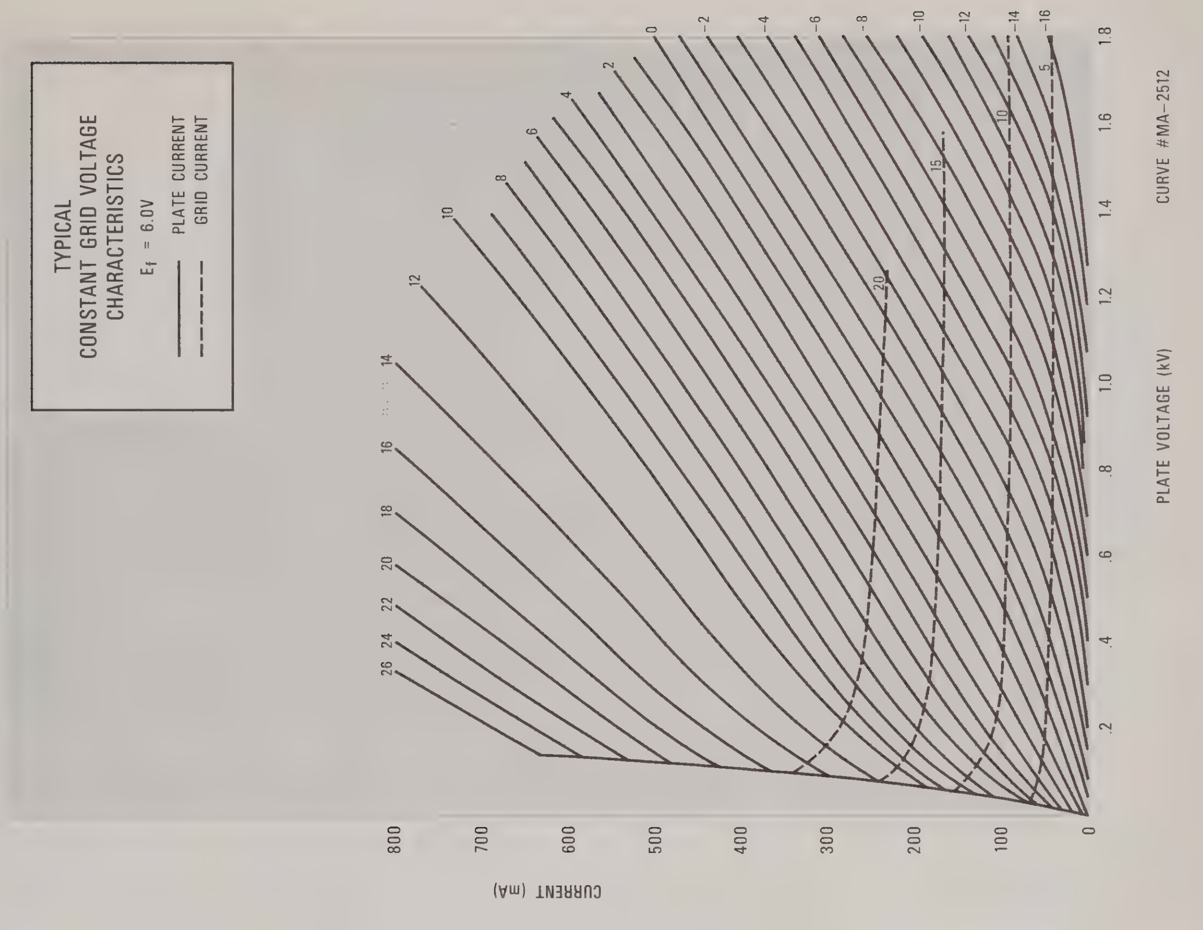
(RELATIVE TO 25°C AND SEA LEVEL)

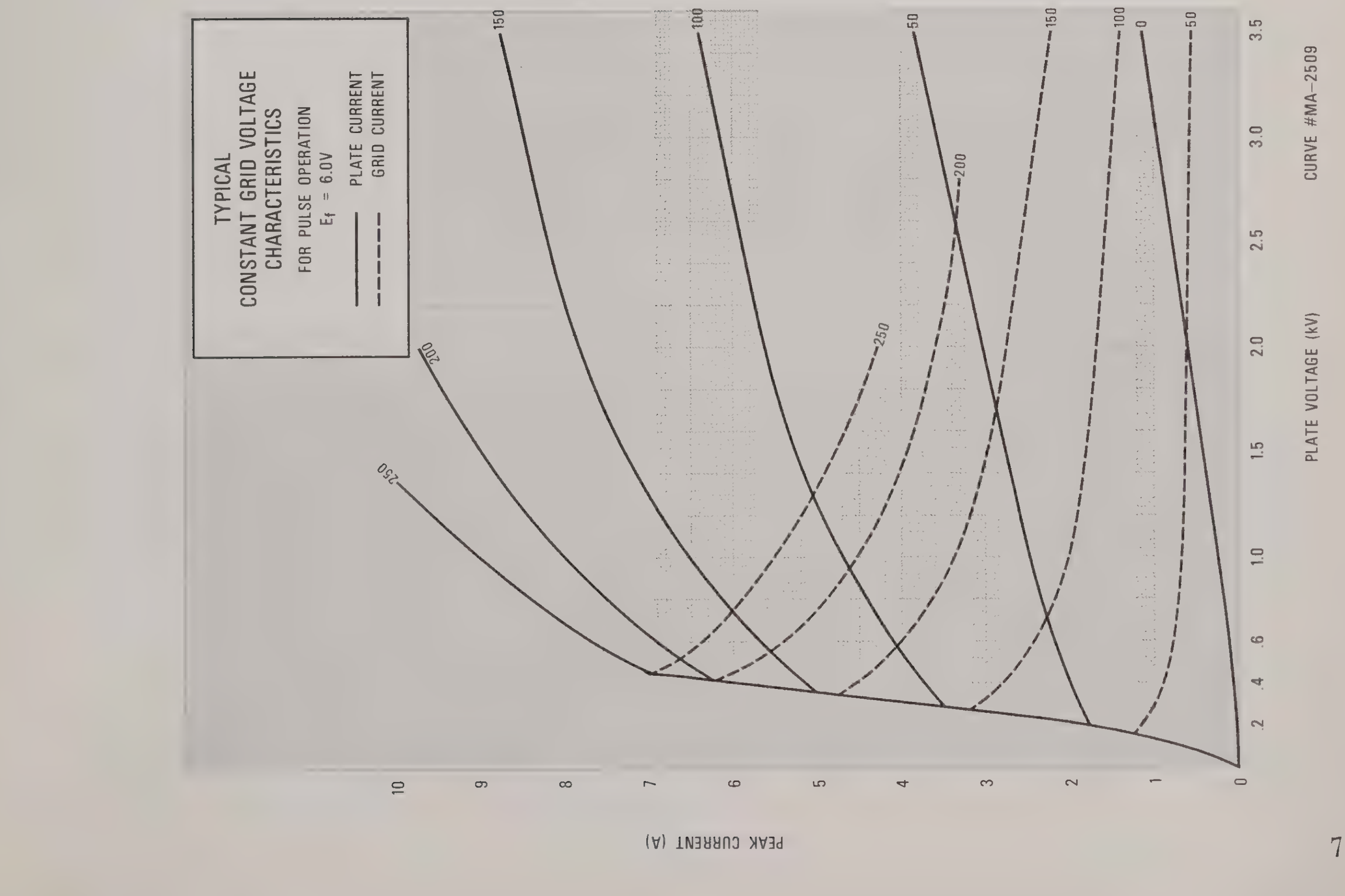


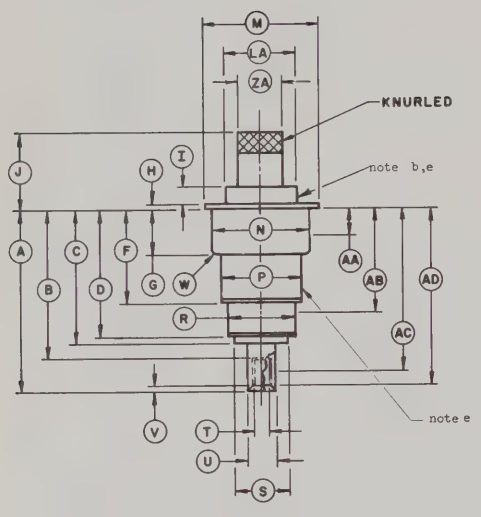

TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
FOR PULSE OPERATION
E_f = 6.0V
PLATE CURRENT (Amperes)
GRID CURRENT (Amperes)
PEAK GRID VOLTAGE (v)
260
240
220
200
180
160
140
120
100
80
60
40
20
0
−20
−40
−60
.2
.4
.6
1.0
1.5
2.0
2.5
3.0
3.5
PLATE VOLTAGE (kV)
CURVE #MA-2510
6.0
5.0
4.0
3.0
2.0
1.0
.5
10
8
6
4
2
1
.5
0



CURVE #MA-2511


TYPICAL
CONSTANT GRID VOLTAGE
CHARACTERISTICS
E_f = 6.0V
PLATE CURRENT
GRID CURRENT
CURRENT (mA)
0
100
200
300
400
500
600
700
800
PLATE VOLTAGE (kV)
.2
.4
.6
.8
1.0
1.2
1.4
1.6
1.8
26
24
22
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
20
15
10
5
CURVE #MA-2512


TYPICAL
CONSTANT GRID VOLTAGE
CHARACTERISTICS
FOR PULSE OPERATION
E_f = 6.0V
PLATE CURRENT
GRID CURRENT
PEAK CURRENT (A)
0
1
2
3
4
5
6
7
8
9
10
PLATE VOLTAGE (kV)
.2
.4
.6
1.0
1.5
2.0
2.5
3.0
3.5
250
200
150
100
50
0
-50
-100
-150
250
200
CURVE #MA-2509



7815

ELECTRODE CONTACT AREA(see note a,f)				
DIM.	MIN.	MAX.	MIN.	MAX.
AA	.035	.361	.89	9.17
AB	1.185	1.265	30.10	32.14
AC	1.534	1.728	38.96	43.89
AD	1.475	1.815	37.47	46.10
	DIM. IN INCHES		DIM. IN MILLIMETERS	

DIMENSION DATA (Note a)					
DIM. IN INCHES		DIM. IN MILLIMETERS			
MIN.	MAX.	DIM.	MIN.	MAX.	NOTES
1.815	1.875	A	46.10	47.62	
	1.534	B		38.96	
	1.475	C		37.46	
1.289	1.329	D	32.74	33.76	
.970	1.010	F	24.64	25.65	
.462	.477	G	11.73	12.12	
	.040	H		1.02	
	.185	I		4.70	
.766	.826	J	19.46	20.98	
1.180	1.195	M	29.97	30.35	
1.025	1.035	N	26.04	26.29	d
.752	.792	P	19.10	20.12	
.655	.665	R	16.64	16.89	d
	.545	S		13.84	
.213	.223	T	5.41	5.66	d
.315	.325	U	8.00	8.26	d
	.086	V		2.18	
	.100	W		2.54	
.840	.860	LA	21.34	21.84	
.427	.447	ZA	10.85	11.35	

NOTES:

a.. Metric equivalents, to the nearest .01 mm, are given for general information only & are based on 1 inch = 25.4 mm.

b. This surface shall be used to measure Anode Shank temperature.

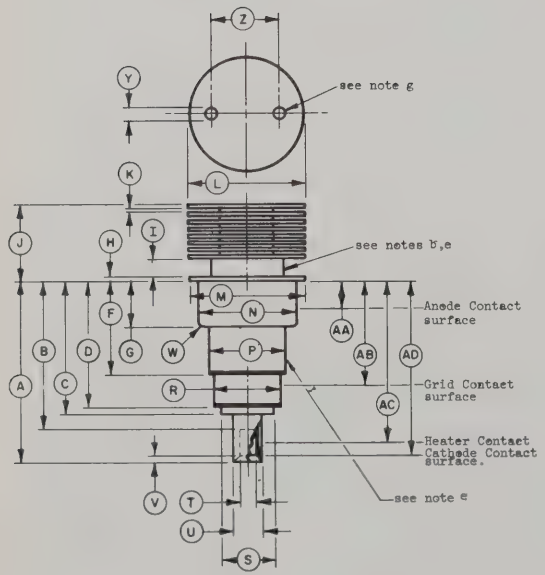
c. Eccentricity of contact surfaces shall be gaged from center line of reference & shall be as follows; note 2 shall apply:

Contact Surface	TIR Max.	Reference
Anode	.020	Cathode
Grid	.020	Cathode
Heater	.012	Cathode

d. Dias. N,R,T,U shall apply throughout entire contact area as defined by dims. AA,AB, AC,AD respectively.

e. This surface shall not be used for clamping or locating.

f. . Electrode Contact Dims. are given for socket design purposes & are not intended for inspection purposes.



7815R

ELECTRODE CONTACT AREA (Note a,f)				
Dim. in Inches			Dim. in Millimeter	
Dim.	Min.	Max.	Min.	Max.
AA	.035	.361	.89	9.17
AB	1.185	1.265	30.10	32.14
AC	1.534	1.728	38.96	43.89
AD	1.475	1.815	37.47	46.10

DIMENSION DATA (Note a)					
Dim. in Inches		Dim. in Millimeters.			
Min.	Max	Dim.	MIN.	MAX.	Notes
1.815	1.875	A	46.10	47.62	
	1.534	B		38.96	
	1.475	C		37.46	
1.289	1.329	D	32.74	33.76	
.970	1.010	F	24.64	25.65	
.462	.477	G	11.73	12.12	
	.040	H		1.02	
.125	.185	I	3.18	4.70	
.766	.826	J	19.46	20.98	
.025	.040	K	.64	1.02	
1.234	1.264	L	31.34	32.11	
1.180	1.195	M	29.97	30.35	
1.025	1.035	N	26.04	26.29	c,d
.752	.792	P	19.20	20.12	
.655	.665	R	16.64	16.89	c,d
	.545	S		13.84	
.213	.223	T	5.41	5.66	c,d
.315	.325	U	8.00	8.26	c,d
	.086	V		2.18	
	.100	W		2.54	
.105	.145	Y	2.67	3.68	
.650	.850	Z	16.51	21.59	

Notes:

a. Metric equivalents to the nearest .01 mm, are given for general information only & are based on 1 inch= 25.4 mm.

b. This surface shall be used to measure anode shank temp.

c. Eccentricity of contact surfaces shall be gaged from center line of reference & shall be as follows:

Contact Surface	TIR Max.	Reference
Anode	.020	Cathode
Grid	.020	Cathode
Heater	.012	Cathode

d. Dias. N,R,T & U shall apply throughout entire lenght as defined be dims. AA,AB,AC & AD respectively.

e. This surface shall not be used for clamping or locating.

f. Electrode Contact dims. are given for socket design purposes & are not intended for inspection purposes.

g. Holes for Tube Extractor thru top fin only.

TECHNICAL DATA

8403

PLANAR TRIODE

The EIMAC Type 8403 is a planar triode featuring frequency stability and an arc resistant cathode of high emission capability assuring stable operation under adverse conditions involving a wide ambient temperature range and varying plate dissipation. This construction, in combination with the proper plate series impedance, reduces to a minimum the possibility of cathode failures due to voltage surges. Other features of this type include high transconductance, high mu, and low interelectrode capacitances coupled with the great mechanical strength of metal/ceramic construction. The cathode is an indirectly heated disc requiring only minimal heater power. The design of the tube permits operation from low frequencies up to 3.0 GHz as a grid-pulsed, plate-pulsed, or CW oscillator, amplifier, or frequency multiplier.

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Cathode: Oxide Coated, Unipotential	
Heater: Voltage	6.3 ± 0.3 V
Current, at 6.3 volts	1.3 A
Transconductance (Average):	
I_b = 160 mA (200 mA/cm^2)	30 mmhos
Amplification Factor (Average):	80
Direct Interelectrode Capacitance (grounded cathode)[2]	
Cin	8.0 pF
Cout (maximum)	0.065 pF
Cgp	3.1 pF
Cut-off Bias (maximum)[3]	-30 V max
Frequency of Maximum Rating:	
C W	2500 MHz
Plate or Grid-Pulsed	3000 MHz

1. Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.
2. Capacitance values are for a cold tube as measured in a special shielded fixture. When the cathode is heated to the proper temperature, the grid-cathode capacitance will increase from the cold value by approximately 1 pF due to thermal expansion of the cathode.
3. Measured with one milliampere plate current and a plate voltage of 1 kVdc.

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MECHANICAL

Maximum Overall Dimensions:	
Length	2.386 in; 60.60 mm
Diameter	1.264 in; 32.11 mm
Net Weight	2.04 oz; 58 gm
Operating Position	Any
Maximum Operating Temperature:	
Ceramic/Metal Seals	250°C
Anode Core	250°C
Cooling	Forced Air
Terminals	Coaxial, special

ENVIRONMENTAL

Shock, 11 ms, non-operating	60 G
Vibration, operating, all axis	10 G
Altitude	60,000 ft.

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.	
Heater: Current at 6.3 volts	1.20	1.40	A
Cathode Warmup Time	60	---	sec.
Interelectrode Capacitance [1]			
Cin	7.5	9.0	pF
Cout	---	0.065	pF
Cgp	2.95	3.25	pF

1. Capacitance value for a cold tube as measured in a special shielded fixture. When the cathode is heated to the proper temperature, the grid-cathode capacitance will increase from the cold value by approximately 1 pF due to thermal expansion of the cathode.

GRID PULSED OR PLATE PULSED AMPLIFIER OR OSCILLATOR

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE(grid pulsed)	2500	VOLTS
PEAK PULSE PLATE VOLTAGE (plate pulsed)	3500	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
Grid negative to cathode	-750	VOLTS
Grid positive to cathode	250	VOLTS
PULSE PLATE CURRENT	5.0	AMPERES
PULSE GRID CURRENT	2.0	AMPERES
AVERAGE PLATE DISSIPATION		
Forced Air Cooling [1]	100	WATTS
GRID DISSIPATION (Average)	2.0	WATTS
FREQUENCY	3.0	GHz
PULSE DURATION [2]	6.0	μs
DUTY FACTOR [2]	.0033	

OPERATING CONDITIONS for 8403 in Representative Application

GRID PULSED OSCILLATOR

Frequency	1.09	GHz
Heater Voltage	6.3	V
DC Plate Voltage	2000	Vdc
DC Grid Voltage	-150	Vdc
Peak Video Plate Current	4.0	a
Peak Video Grid Current	1.0	a
Useful Power Output (Approx.)	1000	w
Pulse Duration	0.5	μs
Duty Factor	.005	

1. Using EIMAC radiator PN 158601.

2. For applications using longer pulse duration and/or higher duty cycle consult the nearest Varian Electron Tube & Devices Field Office, or the Product Manager, EIMAC Division of Varian, Salt Lake, City, Utah.

CW RF POWER AMPLIFIER OR OSCILLATOR

ABSOLUTE MAXIMUM RATINGS:

DC PLATE VOLTAGE	2500	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
Grid negative to cathode	-400	VOLTS
Grid positive to cathode	30	VOLTS
DC PLATE CURRENT	150	MILLIAMPERES
DC GRID CURRENT	45	MILLIAMPERES
AVERAGE PLATE DISSIPATION		
Forced air cooling[1]	100	WATTS
GRID DISSIPATION (Average)	2	WATTS
FREQUENCY	2.5	GHz

OPERATING CONDITIONS for 8403 in Representative Application

GROUNDED GRID CW OSCILLATOR

Frequency	2500	GHz
Heater Voltage	6.0	V
DC Plate Voltage	900	Vdc
DC Grid Voltage (Approx.)	-20	Vdc
DC Plate Current	140	mAdc
DC Grid Current	15	mAdc
Useful CW Power Output	25	W

1. Using EIMAC radiator PN 158601.

PULSE MODULATOR AND PULSE AMPLIFIER SERVICE

ABSOLUTE MAXIMUM RATINGS:

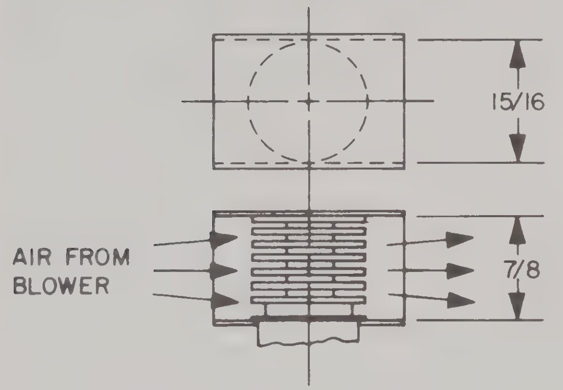
DC PLATE VOLTAGE	3000	VOLTS
PEAK PLATE VOLTAGE	3500	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
Grid negative to cathode	-750	VOLTS
Grid positive to cathode	+150	VOLTS
PULSE CATHODE CURRENT	7.5	AMPERES
DC PLATE CURRENT	150	MILLIAMPERES
AVERAGE PLATE DISSIPATION		
Forced Air Cooling[1]	100	WATTS
GRID DISSIPATION (average)	1.5	WATTS
PULSE DURATION[2]	6.0	μs
CUT-OFF MU	60	
DUTY	.0033	

1. Using EIMAC radiator PN 158601.
2. For applications using longer pulse duration and/or higher duty cycle consult the nearest Varian Electron Tube & Devices Field Office, or the Product Manager, EIMAC Division of Varian, Salt Lake City, Utah.

APPLICATION

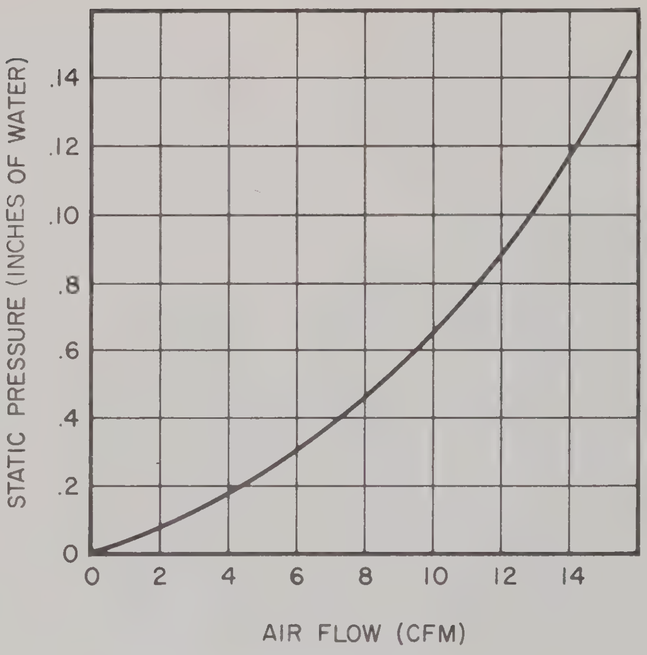
For general application information please refer to the Planar Triode Operating Instruction Sheet. The operating instructions should be consulted prior to the designing of new requirements around the above tube type. For unusual and special applications consult the nearest Varian Electron Tube Field Office, or the Product Manager, EIMAC Division of Varian, Salt Lake City, Utah.

AIRFLOW VS STATIC PRESSURE WITH STANDARD COWLING JAN-157

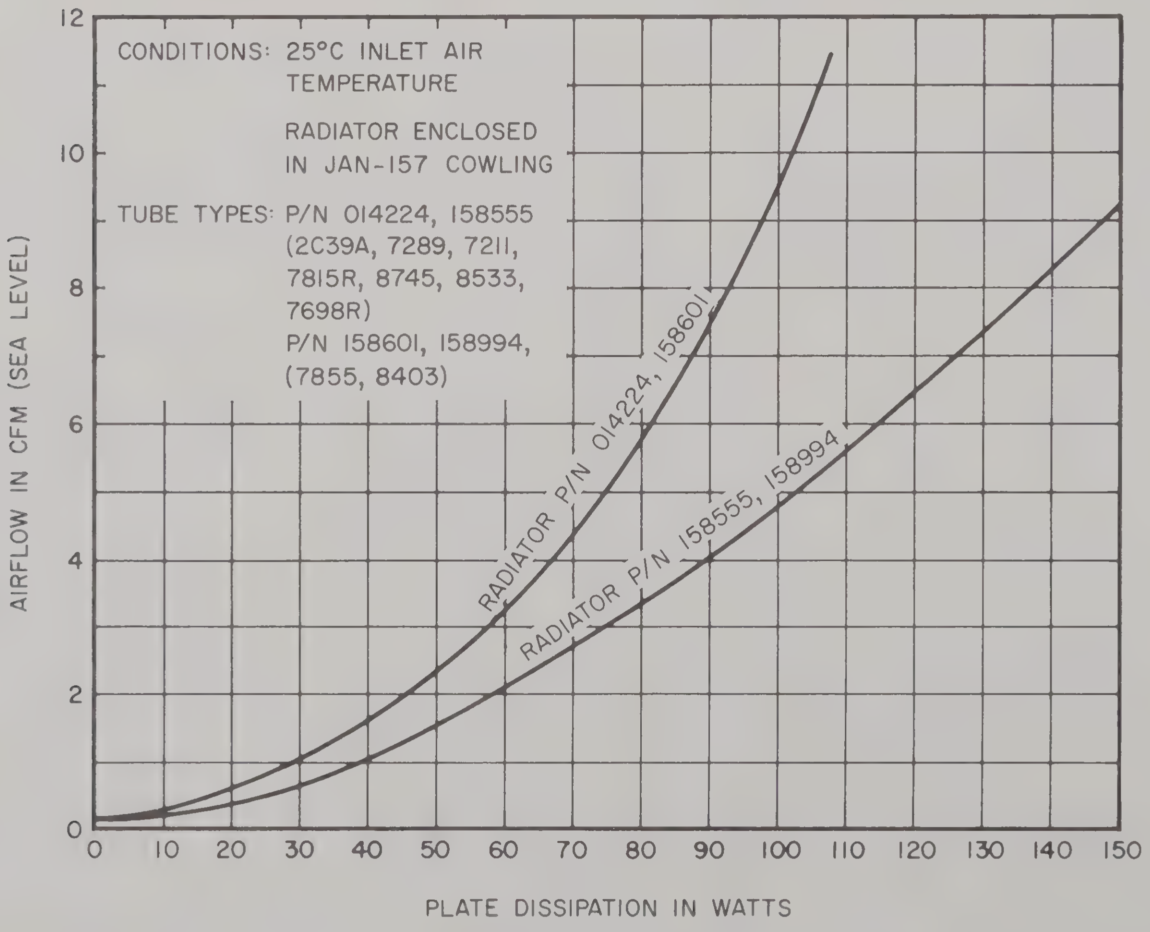


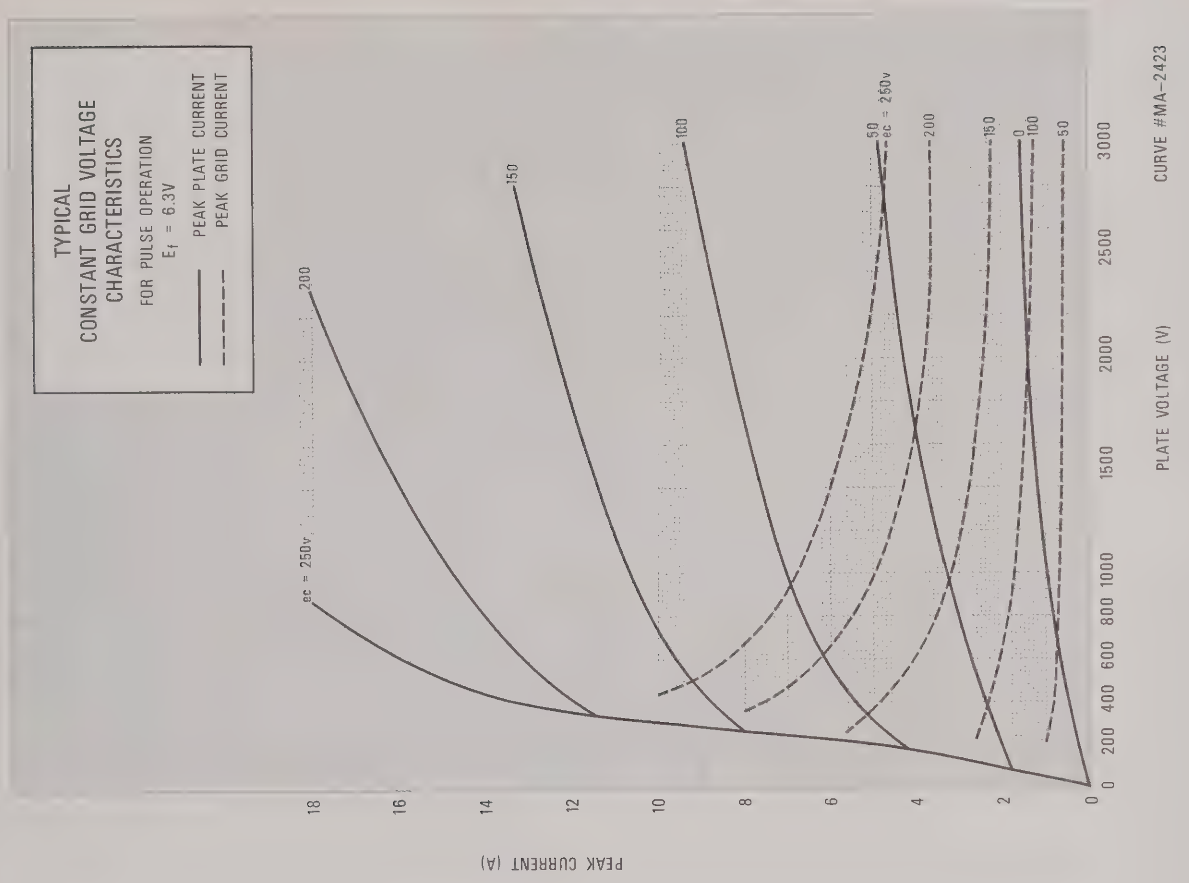
STANDARD COWLING

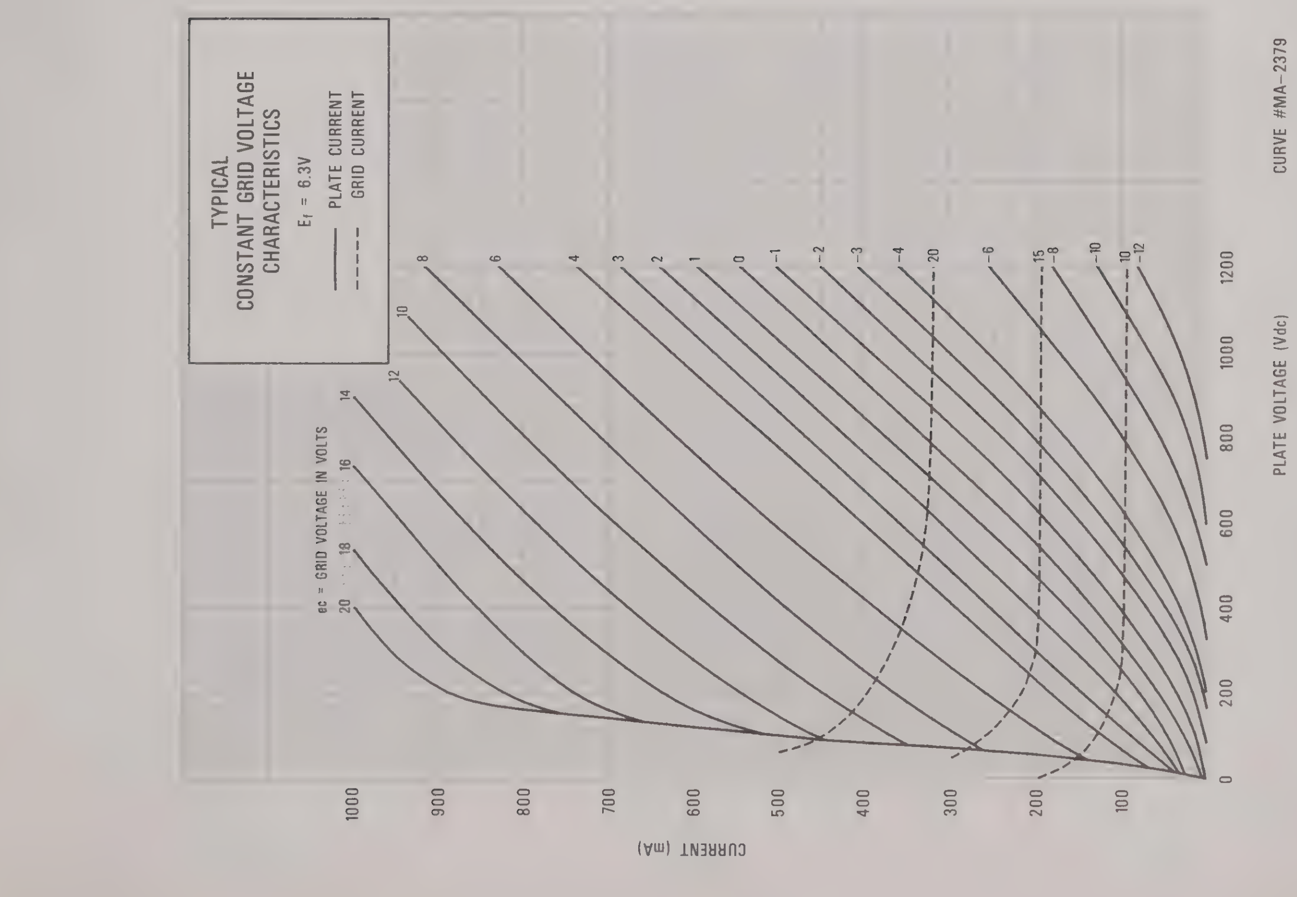
STANDARD COWLING (JAN-157)

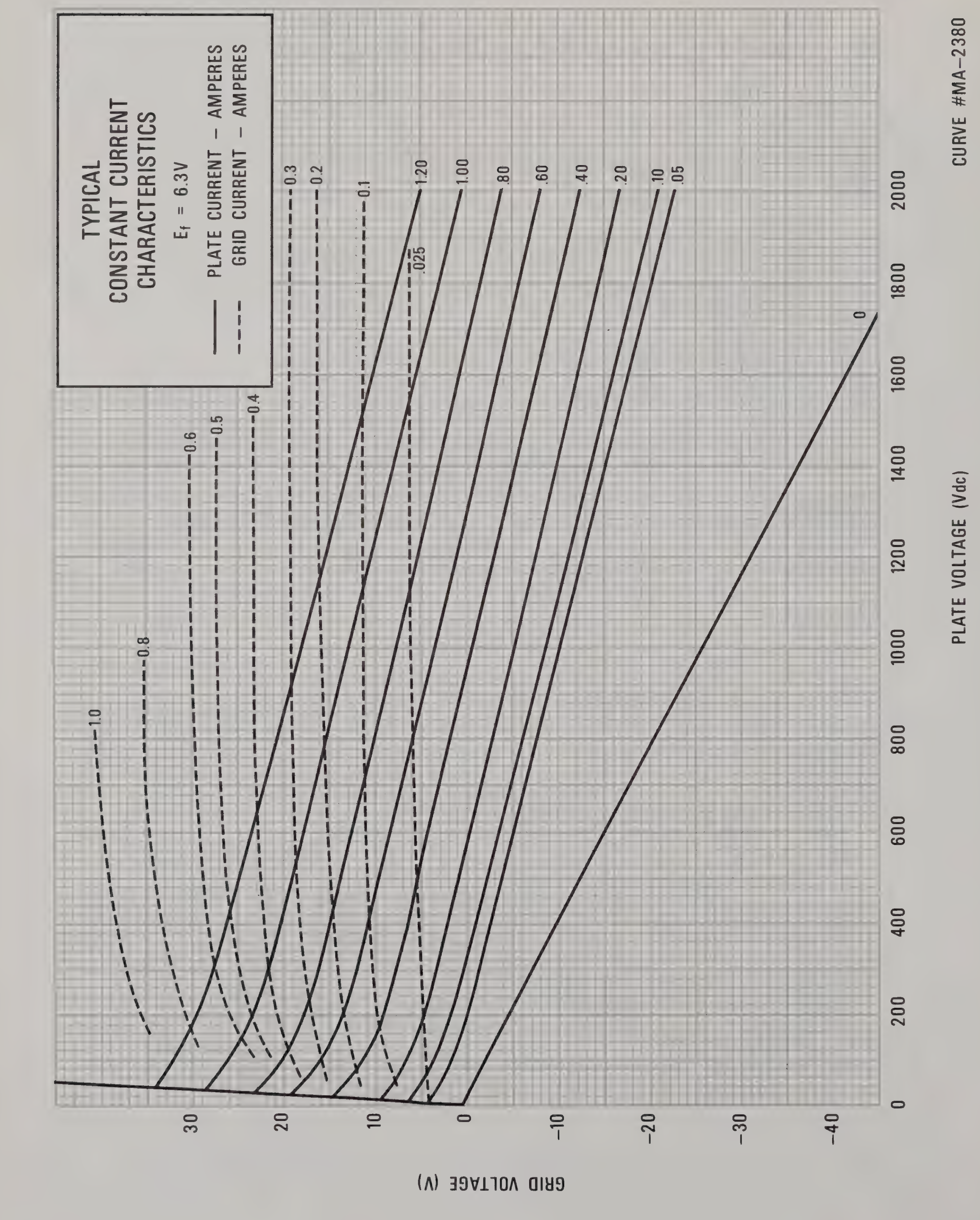


MAXIMUM PLATE DISSIPATION VS COOLING AIRFLOW




TYPICAL
CONSTANT GRID VOLTAGE
CHARACTERISTICS
FOR PULSE OPERATION
E_f = 6.3V
PEAK PLATE CURRENT
PEAK GRID CURRENT
ec = 250v
200
150
100
50
ec = 250v
200
150
0
100
50
PEAK CURRENT (A)
0
2
4
6
8
10
12
14
16
18
PLATE VOLTAGE (V)
0
200
400
600
800
1000
1500
2000
2500
3000
CURVE #MA-2423


TYPICAL
CONSTANT GRID VOLTAGE
CHARACTERISTICS
E_f = 6.3V
PLATE CURRENT
GRID CURRENT
ec = GRID VOLTAGE IN VOLTS
20
18
16
14
12
10
8
6
4
3
2
1
0
-1
-2
-3
-4
20
-6
15
-8
-10
10
-12
CURRENT (mA)
100
200
300
400
500
600
700
800
900
1000
PLATE VOLTAGE (Vdc)
0
200
400
600
800
1000
1200
CURVE #MA-2379



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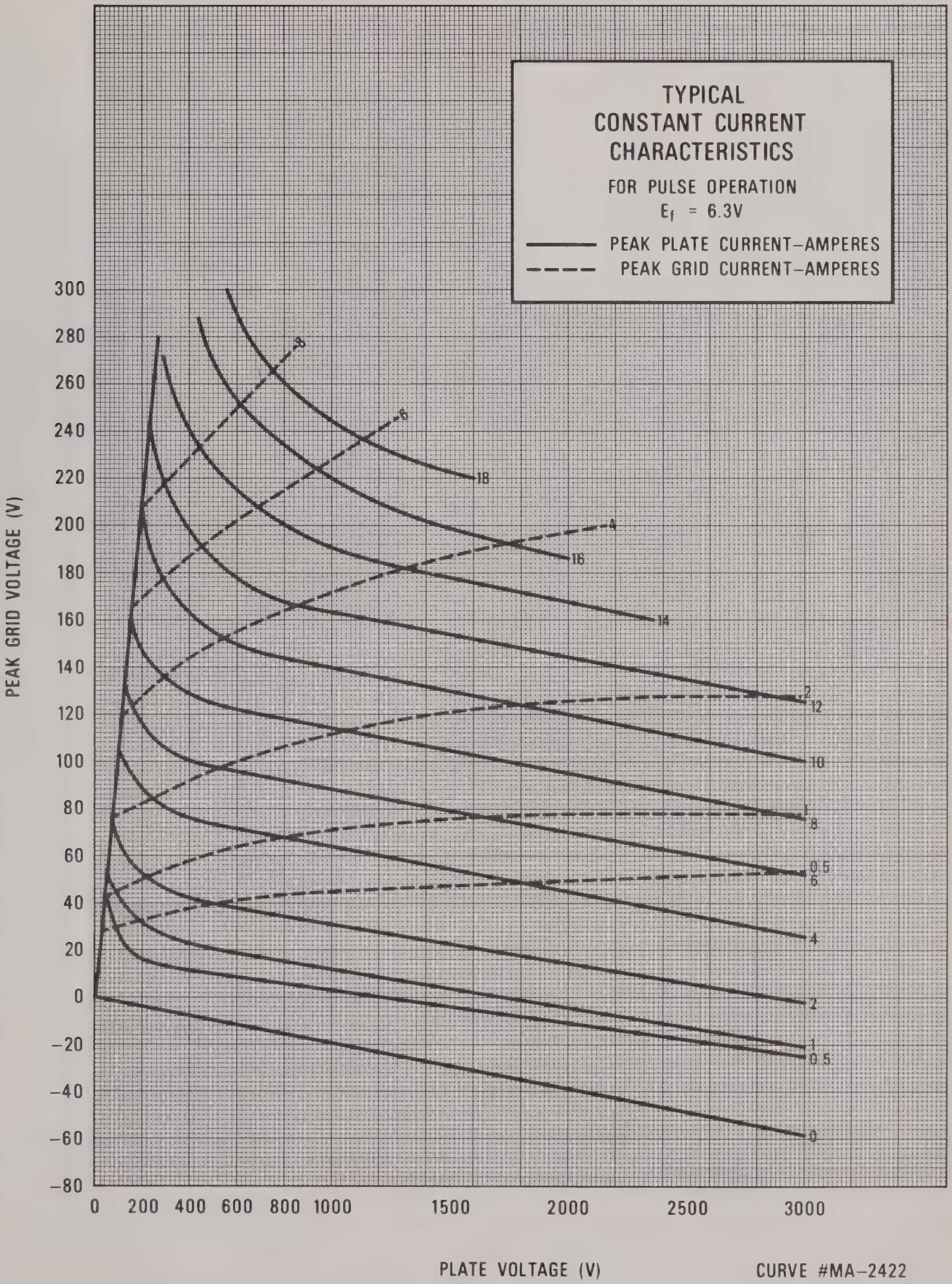

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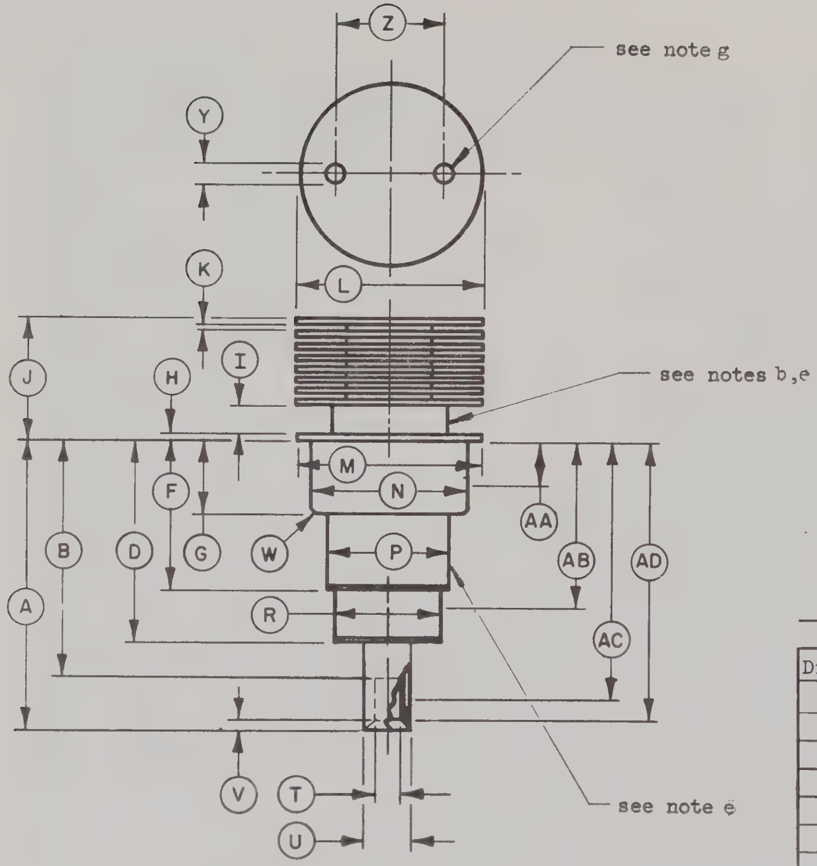

ELECTRODE CONTACT DIMS. (see note a,f)				
Dim. in Inches		Dim.	Dim. in Millim.	
Min.	Max.		Min.	Max.
.035	.361	AA	.89	9.17
1.021	1.101	AB	25.93	27.97
1.219	1.413	AC	30.96	35.89
1.160	1.500	AD	29.46	38.10

DIMENSIONAL DATA (Note a)					
Dim. in Inches			Dim. in Millimeters		
Min.	Max.	Dim.	MIN.	MAX.	
1.500	1.560	A	38.10	39.62	
	1.214	B		30.84	
1.125	1.165	D	28.58	29.59	
.800	.840	F	20.32	21.34	
.462	.477	G	11.73	12.12	
	.040	H		1.02	
.125	.185	I	3.18	4.70	
.766	.826	J	19.46	20.98	
.025	.046	K	.64	1.17	
1.234	1.264	L	31.34	32.11	
1.180	1.195	M	29.97	30.35	
1.025	1.035	N	26.04	26.29	
.752	.792	P	19.10	20.12	
.655	.665	R	16.64	16.89	
.213	.223	T	5.41	5.66	
.315	.325	U	8.00	8.26	
	.086	V		2.18	
	.100	W		2.54	
.105	.145	Y	2.67	3.68	
.650	.850	Z	16.51	21.59	

NOTES:

a. Metric equivalents, to the nearest .01 mm, are given for general information only & are based on 1 inch = 25.4 mm.

b. This surface to be used to measure anode shank temperature.

c. Eccentricity of contact surfaces shall be gaged from center line of reference & shall be as follows:

Contact Surface	TIR Max.	Reference
Anode	.020	Cathode
Grid	.020	Cathode
Heater	.012	Cathode

d. Dias. N,R,T & U shall apply throughout entire lenght as defined by dims. AA,AB,AC,AD respectively.

e. This surface shall not be used for clamping or locating.

f. Electrode Contact dims. are for socket design purposes & are not intended for inspection purposes.

g. Holes for tube extractor thru top fin only

8533

TECHNICAL DATA

PLANAR TRIODE

The EIMAC Type 8533 is a planar triode designed for use as a grid- or plate-pulsed oscillator, amplifier, frequency multiplier, or switch tube at high plate voltages. The tube will operate from low frequencies up to 3.0 GHz. The extended grid-to-anode insulator and a matrix cathode of the arc resistant extended interface type permit reliable operation up to 8 kVdc in RF applications. Other features of this tube type include high transconductance, high mu, and high current capability coupled with great mechanical strength permitting operation at elevated temperatures. The compact metal and ceramic coaxial construction coupled with low interelectrode capacitances make this tube well suited for operation in line type circuits at lower frequencies as well as in cavity resonators at the higher frequencies. The cathode is an indirectly heated disc requiring only minimal heater power.

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Cathode: Oxide Coated, Unipotential		
Heater: Voltage	6.3 ± 0.3	V
Current, at 6.3 volts	1.3	A
Transconductance (Average):		
I_b = 160 mA (200 mA/cm^2)	30	mmhos
Amplification Factor (Average):	145	
Direct Interelectrode Capacitance (grounded cathode)[2]		
Cin	8.0	pF
Cout	0.06	pF
Cgp	1.65	pF
Cut-off Bias[3]	-30	V max.
Frequency of Maximum Rating:		
CW	3000	MHz
Plate or Grid-Pulsed	3000	MHz

---

1. Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design..
2. Capacitance values are for a cold tube as measured in a special shielded fixture. When the cathode is heated to the proper temperature,the grid-cathode capacitance will increase from the cold value by approximately 1 pF due to thermal expansion of the cathode.
3. Measured with one milliampere plate current and a plate voltage of 1 kVdc.

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EIMAC division of varian/301 industrial way/san carlos/california 94070

MECHANICAL

Maximum Overall Dimensions:	
Length	2.701 in; 68.60 mm
Diameter	1.264 in; 32.11 mm
Net Weight	63 gm
Operating Position	Any
Maximum Operating Temperature:	
Ceramic/Metal Seals	250°C
Anode Core	250°C
Cooling	Forced Air
Terminals	Coaxial, special

ENVIRONMENTAL

Shock: 11 ms, non-operating	60 G
Vibration: Operating, All Axis	10 G
Altitude: max., in suitably designed circuit	60,000 ft.

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.	
Heater: Current at 6.3 volts	1.20	1.40	A
Cathode Warmup Time	60	---	sec.
Interelectrode Capacitance[1] (grounded cathode connection)			
Cin	7.00	9.00	pF
Cout	---	0.06	pF
Cgp	1.50	1.80	pF

1. Capacitance values for a cold tube as measured in a special shielded fixture. When the cathode is heated to the proper temperature, the grid-cathode capacitance will increase from the cold value by approximately 1 pF due to thermal expansion of the cathode.

GRID PULSED OR PLATE PULSED AMPLIFIER OR OSCILLATOR

ABSOLUTE MAXIMUM RATINGS:

DC PLATE VOLTAGE (grid pulsed)	8000	VOLTS
PEAK PULSE PLATE VOLTAGE (plate pulsed)	10,000	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
Grid negative to cathode	-750	VOLTS
Grid positive to cathode	150	VOLTS
PULSE PLATE CURRENT	5.0	AMPERES
PULSE GRID CURRENT	2.5	AMPERES
AVERAGE PLATE DISSIPATION		
Forced Air Cooling[1]	100	WATTS
GRID DISSIPATION (Average)	1.5	WATTS
FREQUENCY	3.0	GHz
PULSE DURATION[2]	6.0	μs
DUTY FACTOR[2]	.0033	

1. Using EIMAC radiator PN 014224.

2. For applications using longer pulse duration and/or higher duty cycle consult the nearest Varian Electron Tube & Device Field Office, or the Product Manager, EIMAC Division of Varian, Salt Lake City, Utah.

PULSE MODULATOR AND PULSE AMPLIFIER SERVICE

ABSOLUTE MAXIMUM RATINGS:

DC PLATE VOLTAGE	8000	VOLTS
PEAK PLATE VOLTAGE	10,000	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
Grid negative to cathode . .	-750	VOLTS
Grid positive to cathode . .	150	VOLTS
PULSE CATHODE CURRENT . .	7.5	AMPERES
DC PLATE CURRENT	150	MILLIAMPERES
AVERAGE PLATE DISSIPATION		
Forced Air Cooling[1]	100	WATTS
GRID DISSIPATION (Average)	1.5	WATTS
PULSE DURATION[2]	6.0	μs
DUTY FACTOR[2]	.0033	
CUT-OFF MU	90	

1. Using EIMAC radiator PN 014224.

2. For applications using longer pulse duration and/or higher duty cycle consult the nearest Varian Electron Tube & Device Field Office, or the Product Manager, EIMAC Division of Varian, Salt Lake City, Utah.

APPLICATION

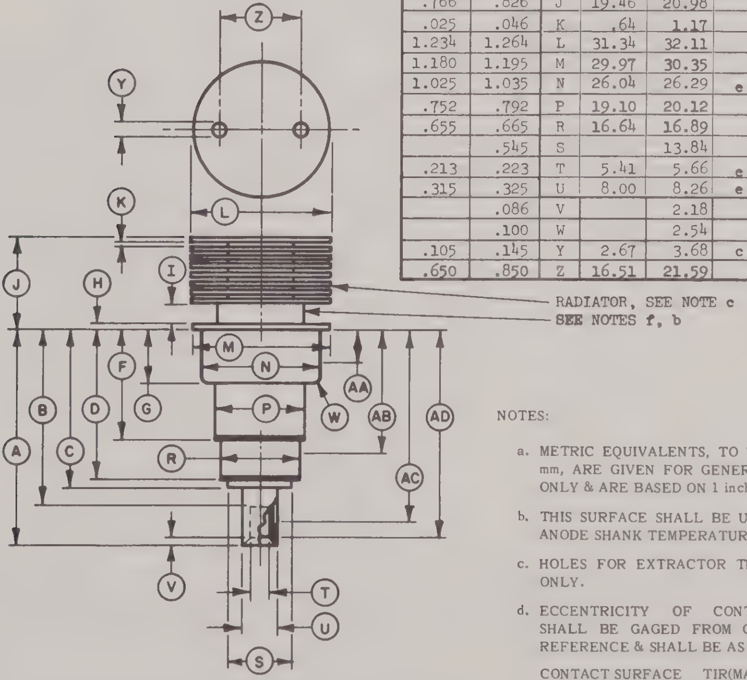
For general application information please refer to the Planar Triode Operating Instruction Sheet. The operating instructions should be consulted prior to the designing of new requirements around the above tube type. For unusual and special applications consult the nearest Varian Electron Tube Field Office, or the Product Manager, EIMAC Division of Varian, Salt Lake City, Utah.

ELECTRODE CONTACT DIMENSION

DIM	MIN.	MAX.	MIN.	MAX.
AA	.035	.361	.89	9.17
AB	1.185	1.265	30.10	32.14
AC	1.534	1.728	38.96	43.89
AD	1.475	1.815	37.47	46.10
	DIM. IN INCHES		DIM. IN MILLIMETERS	

DIMENSION DATA

DIM. IN INCHES			DIM. IN MILLIMETERS		
MIN.	MAX.	DIM	MIN.	MAX.	NOTES
1.815	1.875	A	46.10	47.62	
	1.534	B		38.96	
	1.475	C		37.46	
1.289	1.329	D	32.74	33.76	
.970	1.010	F	24.64	25.65	
.462	.477	G	11.73	12.12	
	.040	H		1.02	
.125	.185	I	3.18	4.70	
.766	.826	J	19.46	20.98	
.025	.046	K	.64	1.17	
1.234	1.264	L	31.34	32.11	
1.180	1.195	M	29.97	30.35	
1.025	1.035	N	26.04	26.29	e
.752	.792	P	19.10	20.12	
.655	.665	R	16.64	16.89	
	.545	S		13.84	
.213	.223	T	5.41	5.66	e
.315	.325	U	8.00	8.26	e
	.086	V		2.18	
	.100	W		2.54	
.105	.145	Y	2.67	3.68	c
.650	.850	Z	16.51	21.59	



NOTES:

a. METRIC EQUIVALENTS, TO THE NEAREST .01 mm, ARE GIVEN FOR GENERAL INFORMATION ONLY & ARE BASED ON 1 inch = 25.4 mm.

b. THIS SURFACE SHALL BE USED TO MEASURE ANODE SHANK TEMPERATURE.

c. HOLES FOR EXTRACTOR THROUGH TOP FIN ONLY.

d. ECCENTRICITY OF CONTACT SURFACES SHALL BE GAGED FROM CENTER LINE OF REFERENCE & SHALL BE AS FOLLOWS:

CONTACT SURFACE	TIR(MAX)	REFERENCE
ANODE	.020	CATHODE
GRID	.020	CATHODE
HEATER	.012	CATHODE

e. DIA'S N, R, T & U SHALL APPLY THROUGHOUT ENTIRE LENGTH AS DEFINED BY DIM'S AA, AB, AC & AD RESPECTIVELY.

f. THIS SURFACE SHALL NOT BE USED FOR CLAMPING OR LOCATING.

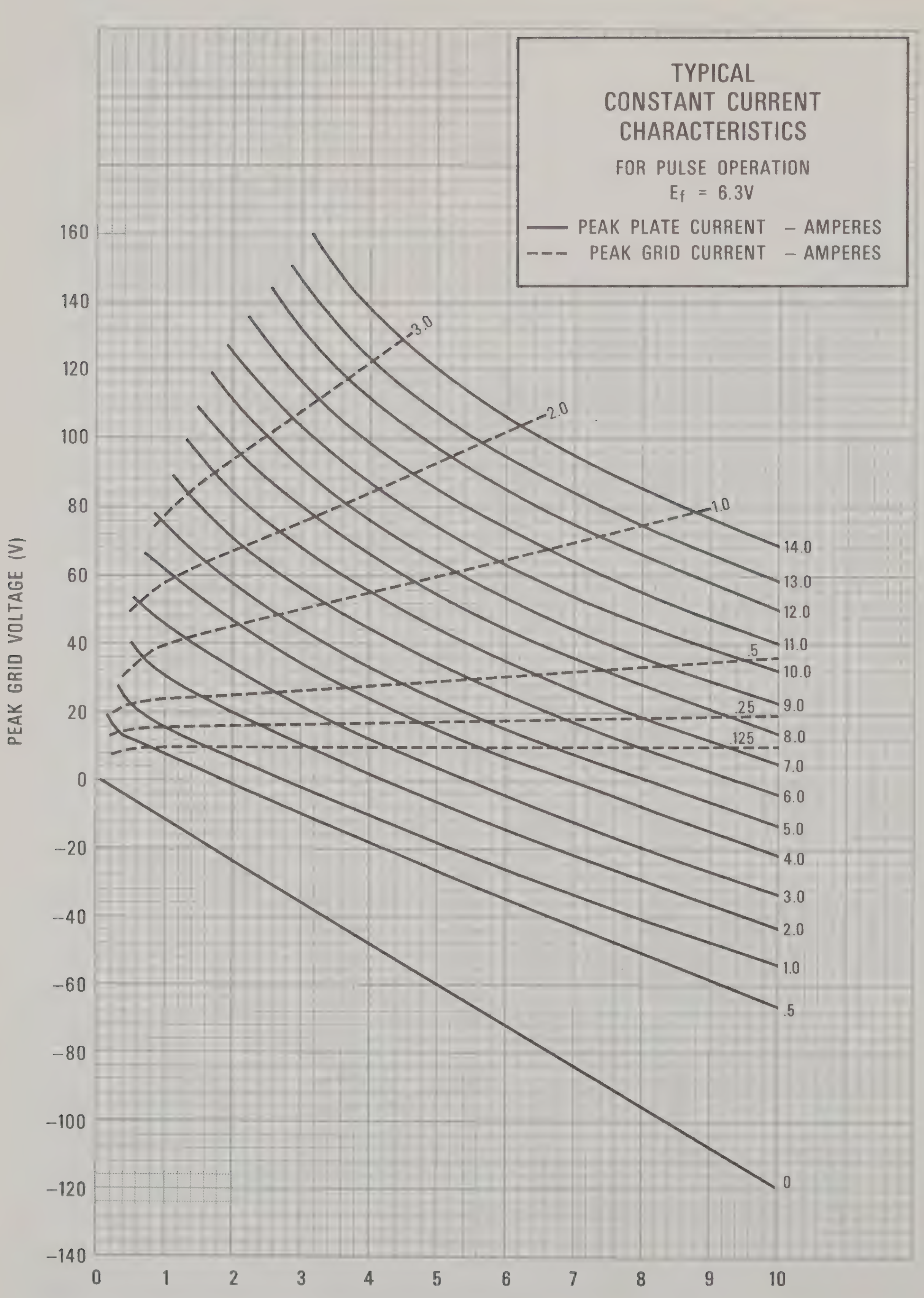
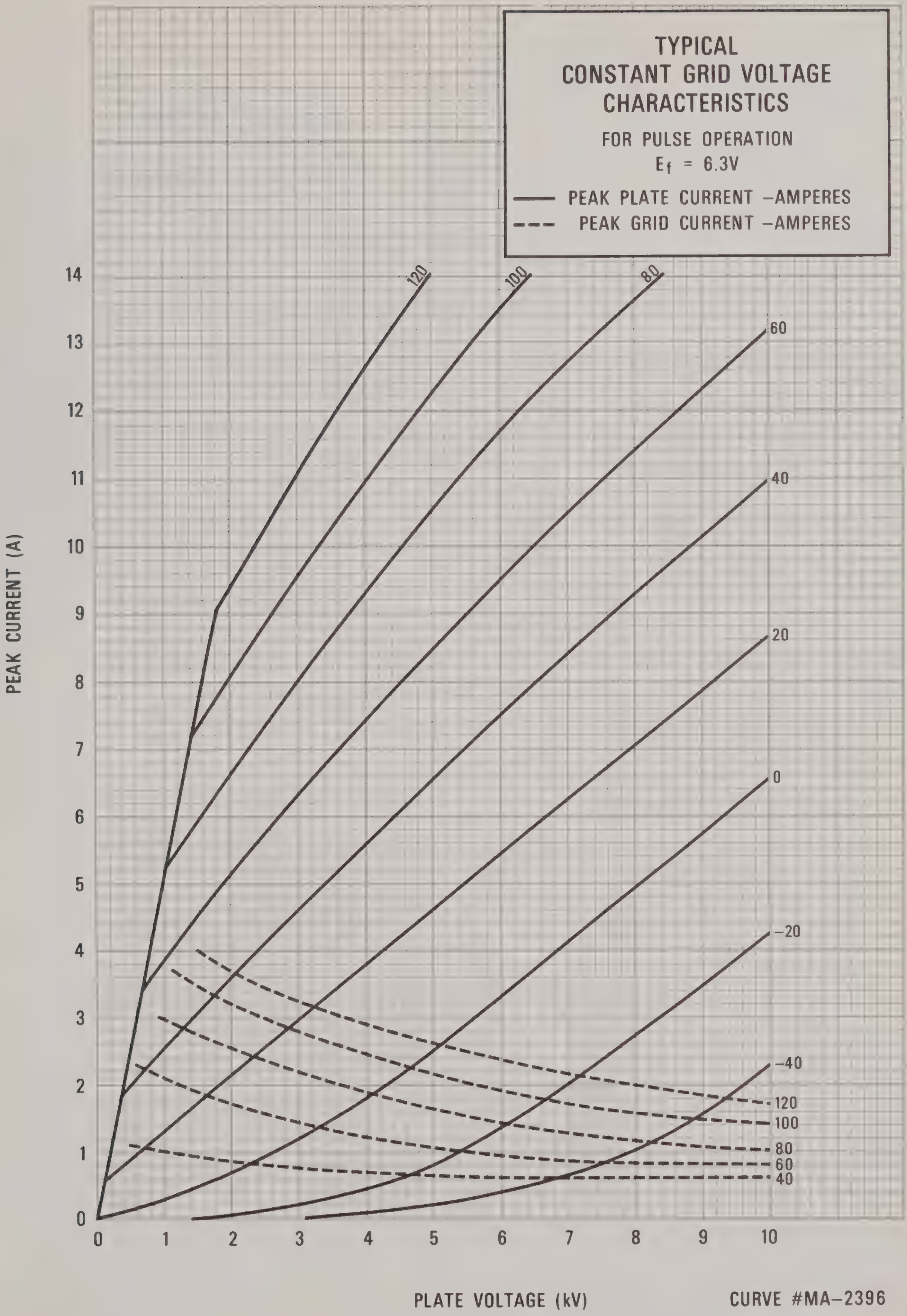


PLATE VOLTAGE (kV)

CURVE #MA–2395


TYPICAL
CONSTANT GRID VOLTAGE
CHARACTERISTICS
FOR PULSE OPERATION
E_f = 6.3V
—— PEAK PLATE CURRENT –AMPERES
- - - PEAK GRID CURRENT –AMPERES
PEAK CURRENT (A)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
PLATE VOLTAGE (kV)
0
1
2
3
4
5
6
7
8
9
10
120
100
80
60
40
20
0
–20
–40
120
100
80
60
40
CURVE #MA–2396

TYPICAL CONSTANT PLATE CURRENT CHARACTERISTICS

NEGATIVE GRID REGION E_f = 6.3V

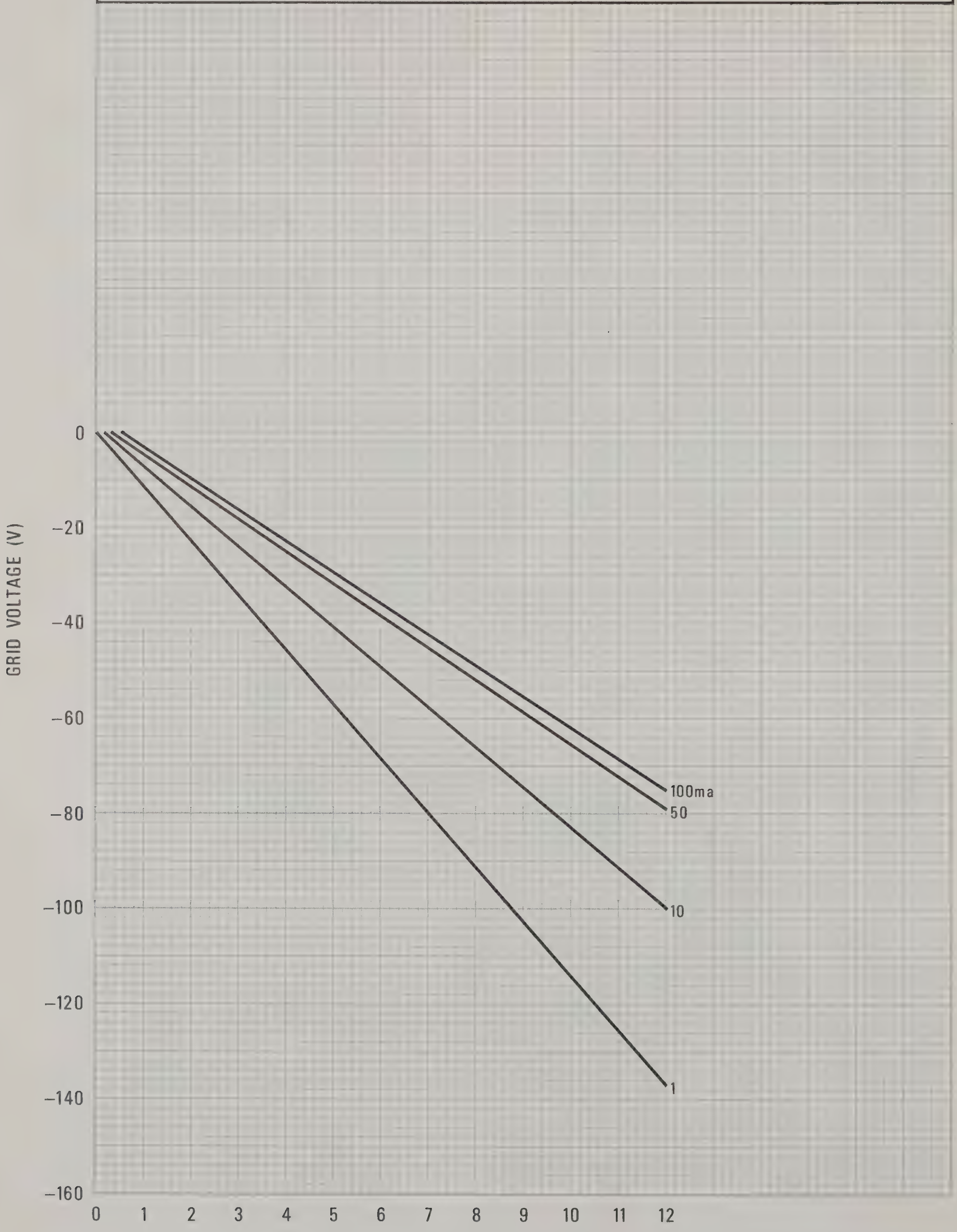


PLATE VOLTAGE (kV)

CURVE #MA-2397

EIMAC
Division of Varian
SAN CARLOS
CALIFORNIA

8847
8847A

HIGH-MU PLANAR TRIODES

The 8847 and 8847A are miniature, ceramic/metal, rugged planar triodes for advanced airborne and space applications up to 3.5 GHz.

The 8847A is identical to the 8847 in all respects except that the required heater power is reduced by 25%. The tube should be used where input power consumption and heat dissipation are of major concern.

Either tube may be used as an amplifier, oscillator, or frequency multiplier in the CW, grid- or plate-pulsed mode, as well as a modulator or regulator tube. In addition to low interelectrode capacitances, high transconductance and amplification factor, the 8847 and 8847A have an anode designed to enhance frequency stability and an arc-resistant cathode, both assuring stable, reliable and long-life operation under adverse conditions.

The 8847 and 8847A are supplied without radiator and may be conduction, convection, heat sink, or liquid cooled. Radiators for forced-air cooling permitting an anode dissipation up to 150 watts, can be furnished on separate order.

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Cathode:Oxide Coated, Unipotential	
Heater: Voltage	6.3 ± 0.3 V
8847 Current, at 6.3 volts	1.30 A
8847A Current, at 6.0 volts	0.95 A
Transconductance (Average):	
I_b = 160 mA (200 mA/cm^2)	38 mmhos
Amplification Factor (Average):	75
Direct Interelectrode Capacitances (Grounded Cathode)[2]	
Grid-Cathode	9.5 pF
Plate-Cathode	0.06 pF
Grid-Plate	1.40 pF
Cut-off Bias[3]	-30 V max.

---

1. Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment.

2. Capacitance values for a cold tube as measured in a special shielded fixture. When the cathode is heated to the proper temperature, the grid-cathode capacitance will increase from the cold value by approximately 1 pF due to thermal expansion of the cathode.

3. Measured with one milliampere plate current and a plate voltage of 1 kVdc.

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MECHANICAL

Maximum Overall Dimensions:

Length	1.370 in; 34.75 mm
Diameter	0.785 in; 19.94 mm
Net Weight	0.56 oz; 16.0 gm
Operating Position	Any

Maximum Operating Temperature:

Ceramic/Metal Seals	250°C
Anode Core	250°C
Cooling	Conduction, convection, forced-air[1] or liquid
Terminals	Coaxial, special

ENVIRONMENTAL

Shock, 11 ms, non-operating	60 G
Vibration, operating, all axes 55 to 500 Hz	10 G
Altitude, max (in suitable designed circuit)	70,000 ft.

CW RF POWER AMPLIFIER OR OSCILLATOR

MAXIMUM RATINGS/ABSOLUTE VALUES

DC PLATE VOLTAGE	2500	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
Grid negative to cathode	-400	VOLTS
Grid positive to cathode	30	VOLTS
DC PLATE CURRENT	250	MILLIAMPERES
DC GRID CURRENT	45	MILLIAMPERES
PLATE DISSIPATION[1]	150	WATTS
GRID DISSIPATION	1.5	WATTS
FREQUENCY	3.0	GIGAHERTZ

GRID PULSED OR PLATE PULSED AMPLIFIER OR OSCILLATOR

MAXIMUM RATINGS/ABSOLUTE VALUES

DC PLATE VOLTAGE(GRID PULSED)	3000	VOLTS
PEAK PULSE PLATE VOLTAGE (PLATE PULSED)	3500	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
Grid negative to cathode	-700	VOLTS
Grid positive to cathode	175	VOLTS
PULSE PLATE CURRENT	5.0	AMPERES
PUSLE GRID CURRENT	2.5	AMPERES
PLATE DISSIPATION[1]	150	WATTS
GRID DISSIPATION	1.5	WATTS
FREQUENCY	3.5	GIGAHERTZ
PULSE DURATION[2]	6	μsec
DUTY FACTOR[2]	.0033	

REPRESENTATIVE OPERATION

Grid-Pulsed rf Power Oscillator (1.6 GHz)

DC Plate Voltage	3000	Vdc
Peak Plate Current	3.0	a
DC Grid Voltage (Approx.)	-90	V
Peak Grid Current	1.0	a
Filament Voltage	6.3	V
Useful Power Output (Approx.)	3000	w
Bandwidth (1db)	40	MHz
Plate Efficiency	33%	

[1] Using one of the EIMAC radiators shown on the cooling curves.

[2] For application requiring longer pulse duration and/or higher duty cycle consult the nearest Varian Electron Tube and Devices Field Office, or the Product Manager, Eimac-Division of Varian, Salt Lake City, Utah.

PULSE MODULATOR OR PULSE AMPLIFIER SERVICE

MAXIMUM RATINGS/ABSOLUTE VALUES

DC PLATE VOLTAGE	3500	VOLTS
PEAK PLATE VOLTAGE	4000	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
Grid negative to cathode	-750	VOLTS
Grid positive to cathode	150	VOLTS
PULSE CATHODE CURRENT	7.5	AMPERES
DC PLATE CURRENT	150	MILLIAMPERES
PLATE DISSIPATION[1]	150	WATTS
GRID DISSIPATION	1.5	WATTS
PULSE DURATION	6	μs
DUTY FACTOR	.0033	
CUT-OFF MU	60	

1. Using one of the EIMAC radiators shown on the cooling curves.
2. For application requiring longer pulse duration and/or higher duty cycle consult the nearest Varian Electron Tube and Device Field Office, or the Product Manager Eimac-Division of Varian, Salt Lake City, Utah.

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.	
Heater current at 6.3 volts (8847)	1.20	1.40	A
Heater current at 6.0 volts (8847A)	0.85	1.05	A
Cathode Heating Time	60	---	sec.
Interelectrode Capacitances[1] (grounded cathode connection)			
Grid-Cathode	8.5	10.5	pF
Plate-Cathode	---	0.06	pF
Grid-Plate	1.2	1.6	pF

[1] Capacitance values for a cold tube as measured in a special shielded fixture. When the cathode is heated to the proper temperature, the grid-cathode capacitance will increase from the cold value by approximately 1 pF due to thermal expansion of the cathode.

APPLICATION

COOLING - The 8847 and 8847A can be cooled by conduction, convection, forced-air or liquid cooling. The tubes are designed to permit high-temperature operation up to the limit indicated. However, if long life is the prime objective, tube terminal and seal temperatures should be kept well below 250°C. If forced-air cooling is provided, auxiliary air flow, apart from the air flowing through the radiator, should be provided to cool the tube envelope and other tube terminals. Some conduction cooling is always provided through the contact terminals. However, these terminals usually exhibit poor heat transfer, often having a temperature gradient across them as high as 50°C. Cooling curves are given for the three radiators which are suitable for use with the 8847 and 8847A.

For further details on cooling or other aspects of tube operation, refer to the "Application Notes for Planar Triodes" bulletin which can be obtained on request.

DIMENSIONAL DATA

DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	- -	1.020	- -	- -	25.91	- -
D	0.740	0.800	- -	18.80	20.32	- -
F	- -	0.570	- -	- -	14.48	- -
G	0.150	0.170	- -	3.81	4.32	- -
H	- -	0.040	- -	- -	1.02	- -
J	- -	0.350	- -	- -	8.90	- -
L	- -	0.260	- -	- -	6.60	- -
M	0.545	0.570	- -	13.84	14.48	- -
P	0.775	0.785	- -	19.69	19.94	- -
R	0.650	0.670	- -	16.51	17.02	- -
T	0.210	0.225	- -	5.33	5.72	- -
U	0.310	0.330	- -	7.87	8.38	- -
V	- -	0.040	- -	- -	1.07	- -
AB	0.590	0.740	- -	14.99	18.80	- -
AC	0.760	0.885	- -	19.30	22.48	- -
AD	0.800	0.975	- -	20.32	24.77	- -

NOTES:

1. REF. DIMENSIONS ARE FOR INFO. ONLY & ARE NOT REQUIRED FOR INSPECTION PURPOSES.

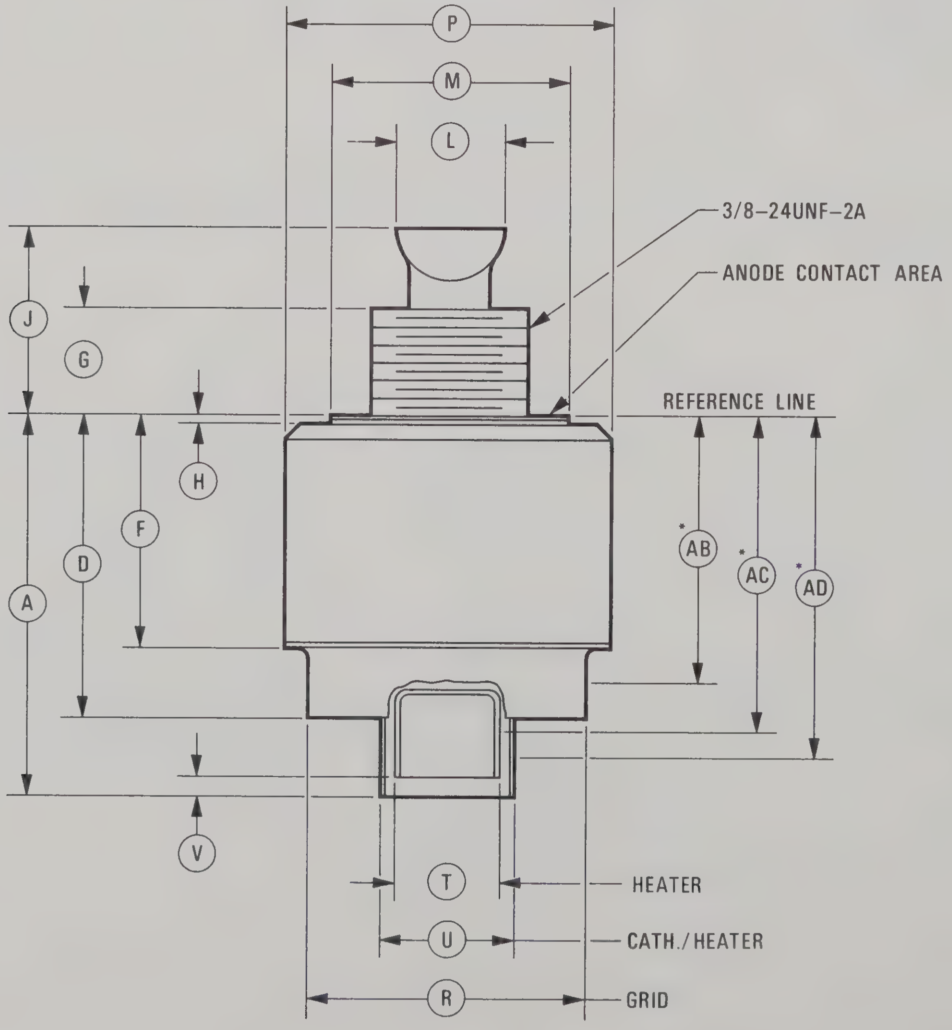
NOTES:

1. ANODE FLANGE IS ELECTRICAL CONTACT. STUD IS FOR HEAT TRANSFER.

2. (*) DISTANCE FROM REFERENCE SURFACE TO THE CENTER OF CONTACT AREA.

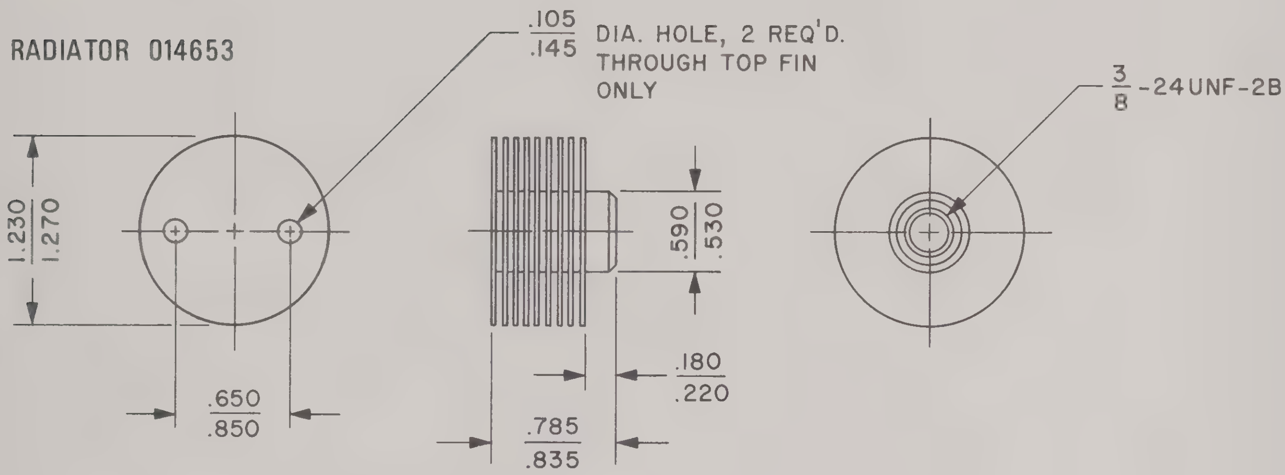
3. METRIC EQUIVALENTS ARE TO THE NEAREST .01 mm, ARE GIVEN FOR GENERAL INFORMATION ONLY, AND ARE BASED ON 1 INCH = 25.4 mm.

4. CONCENTRICITY BETWEEN GRID TERMINAL AND CATHODE/HEATER TERMINAL RESPECTIVELY TO THE ANODE STUD TO BE 0.020 TIR MAX. MEASUREMENT TO BE MADE WITH EIMAC GAGE JA-21685G WHICH MUST SEAT AGAINST THE ANODE FLANGE.

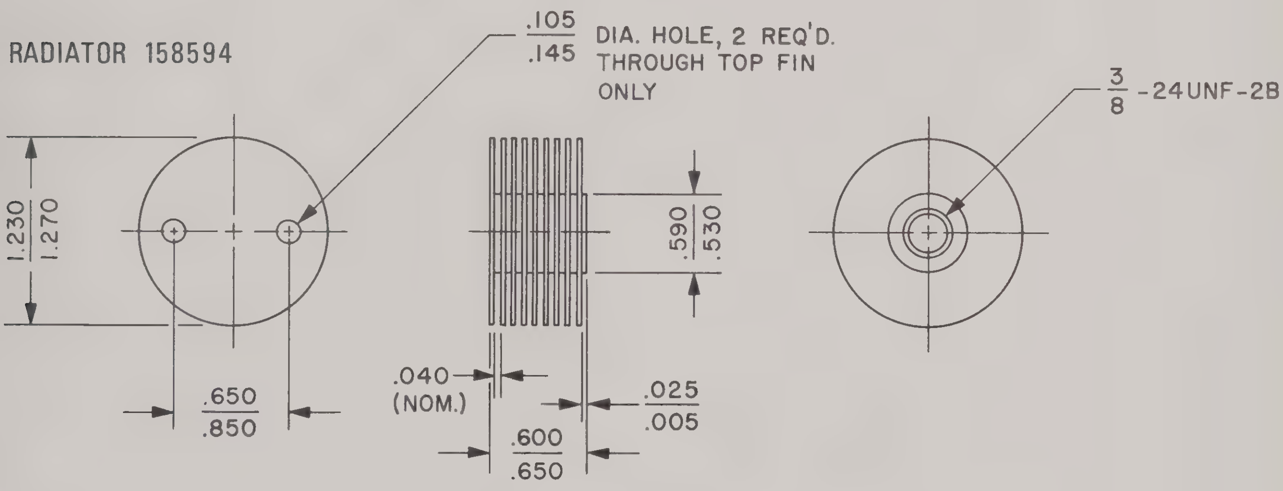


EIMAC RADIATORS

RADIATOR 014653



RADIATOR 158594



RADIATOR 158593

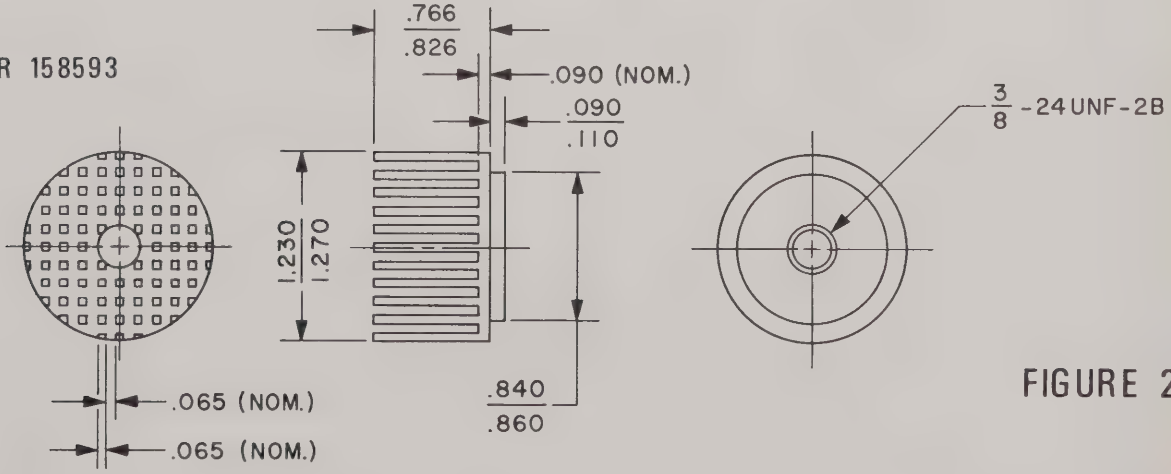


FIGURE 2

FIGURE 3

COMBINED CORRECTION FACTORS FOR INLET AIR TEMPERATURE AND ALTITUDE

(RELATIVE TO 25°C AND SEA LEVEL)

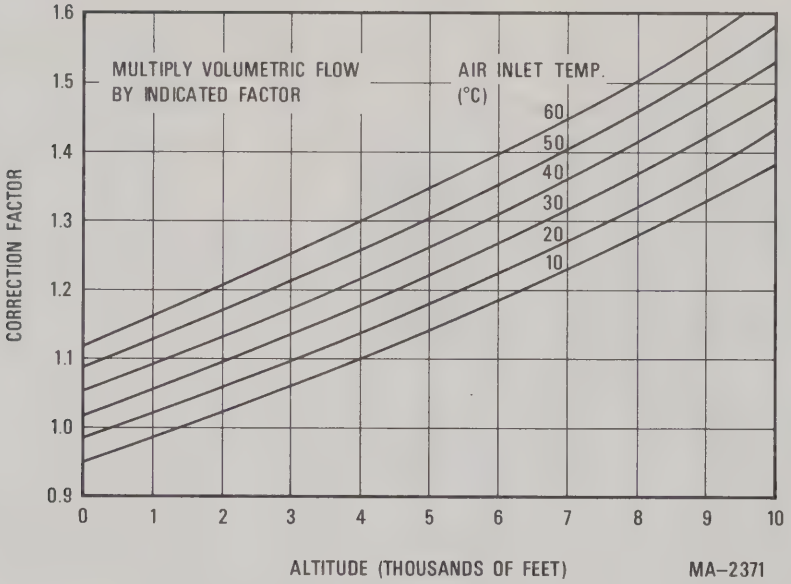
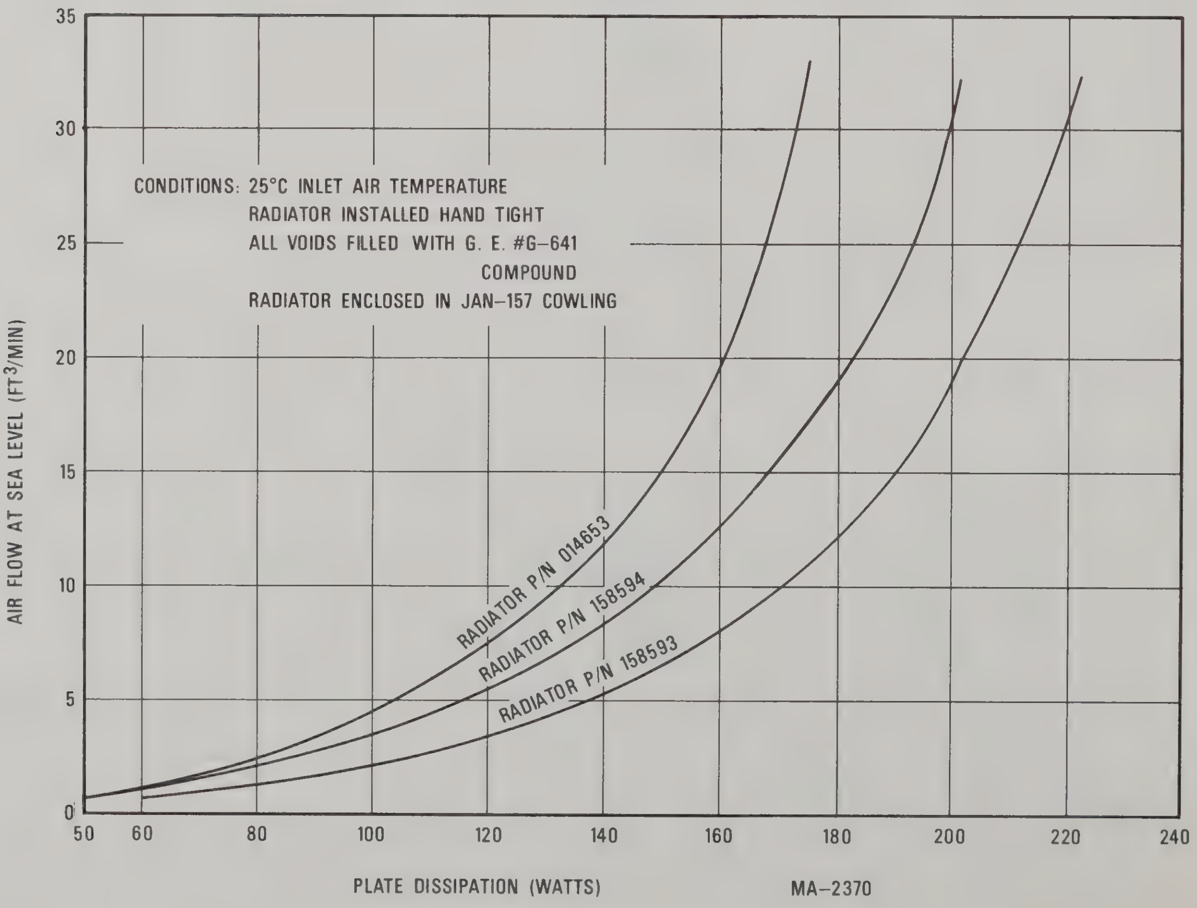
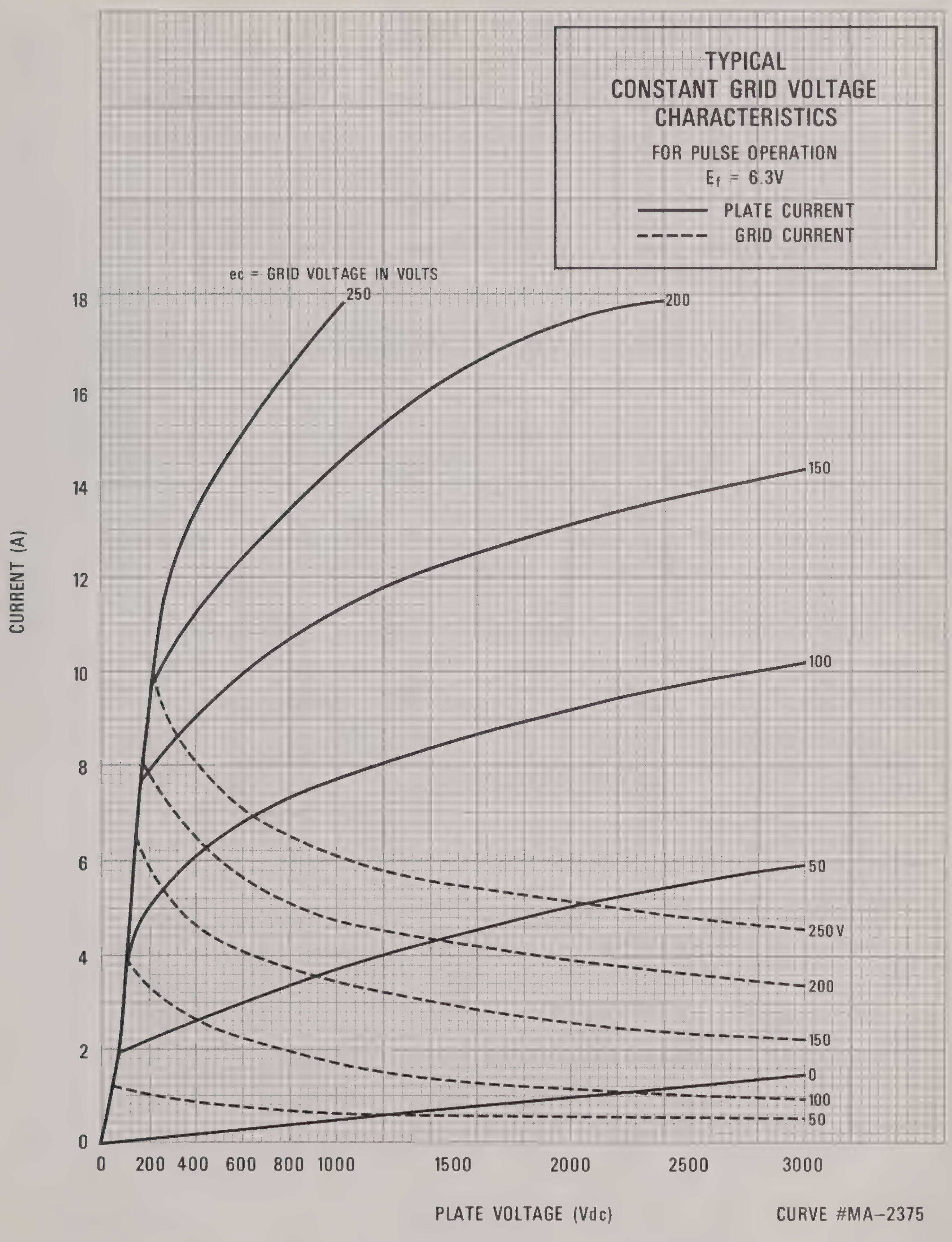


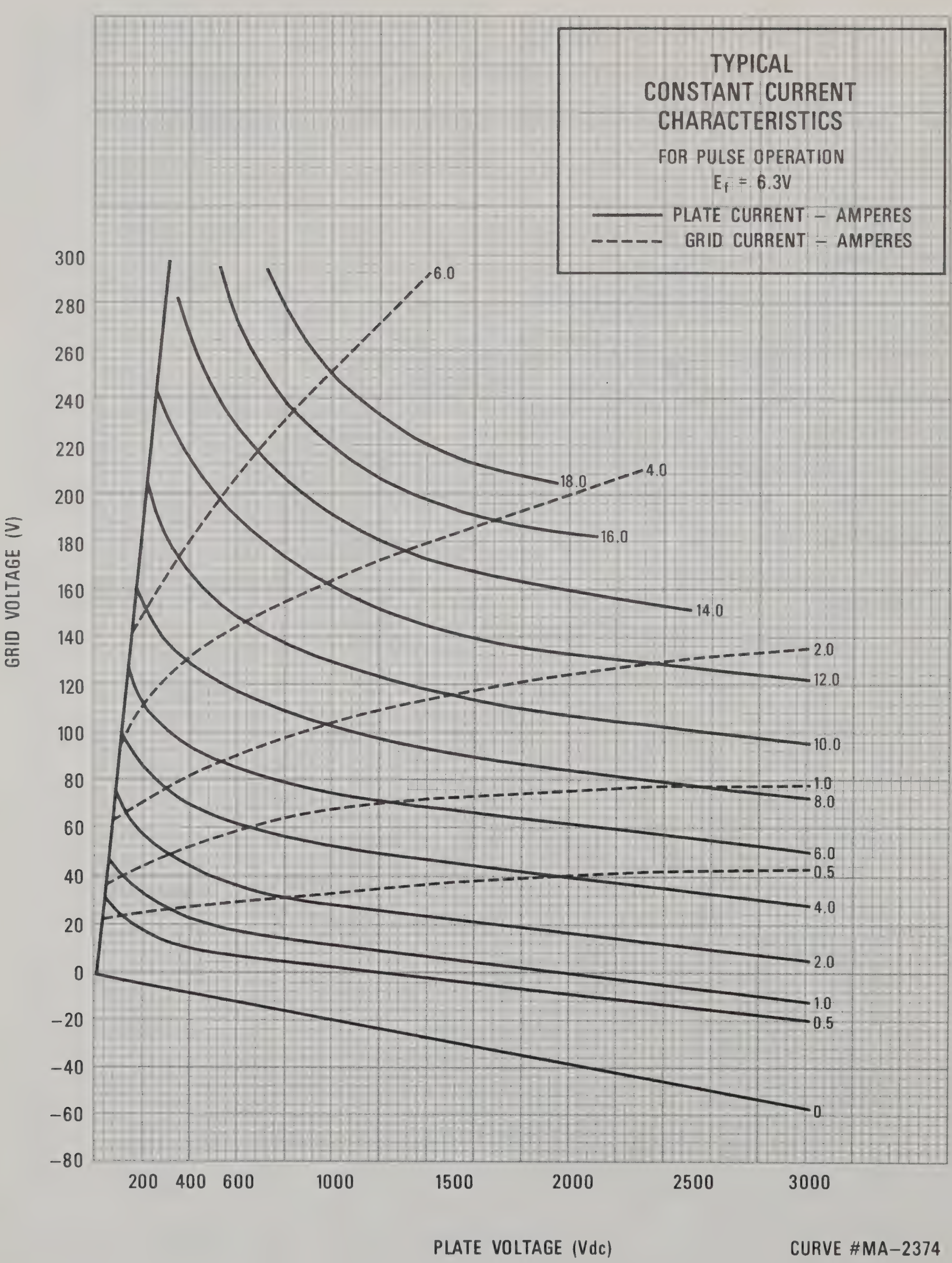
FIGURE 4

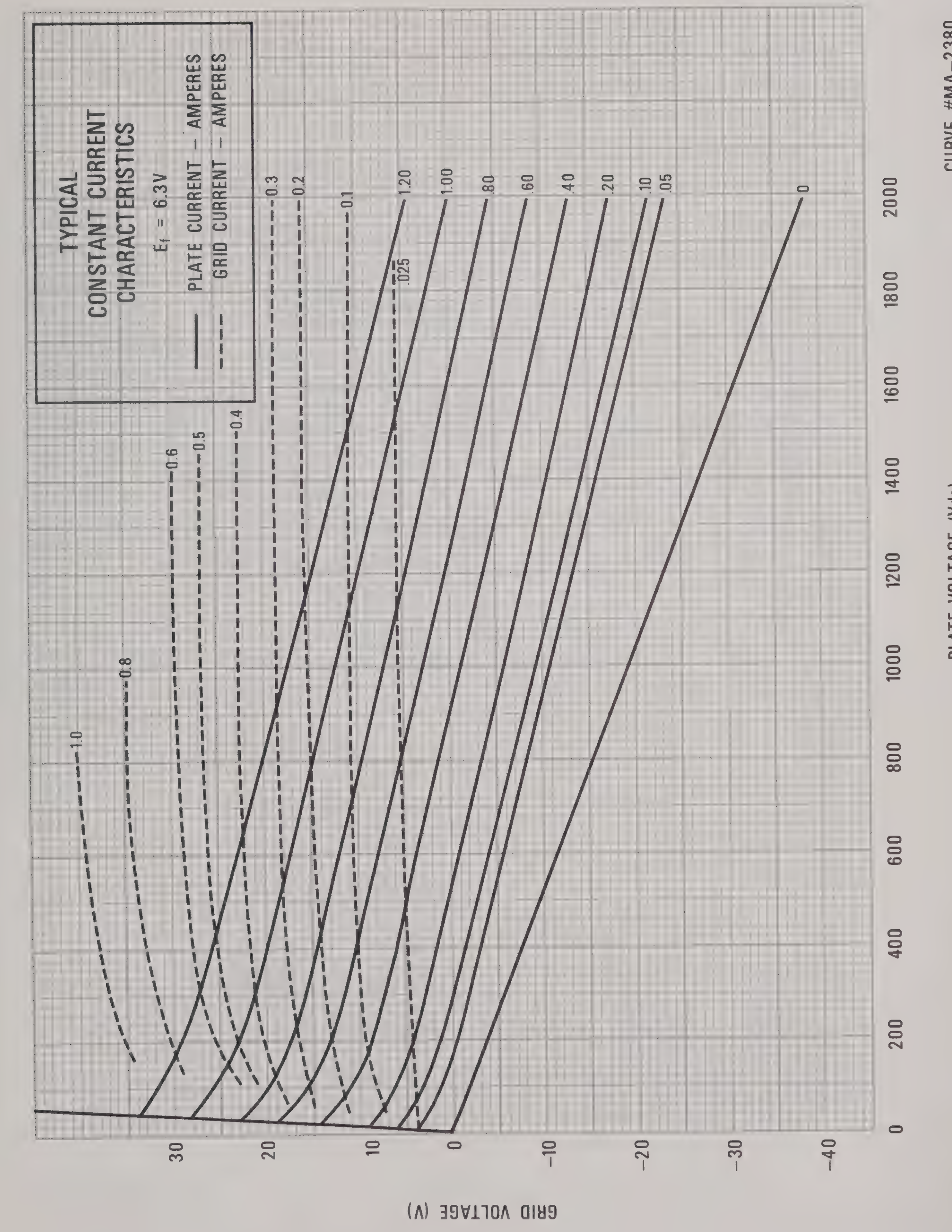
PLATE DISSIPATION VARIATION WITH COOLING AIR FLOW





CURVE #MA–2375


TYPICAL CONSTANT CURRENT CHARACTERISTICS
FOR PULSE OPERATION
E_f = 6.3V
PLATE CURRENT – AMPERES
GRID CURRENT – AMPERES
GRID VOLTAGE (V)
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
−20
−40
−60
−80
PLATE VOLTAGE (Vdc)
200
400
600
1000
1500
2000
2500
3000
6.0
18.0
4.0
16.0
14.0
2.0
12.0
10.0
1.0
8.0
6.0
0.5
4.0
2.0
1.0
0.5
0
CURVE #MA-2374



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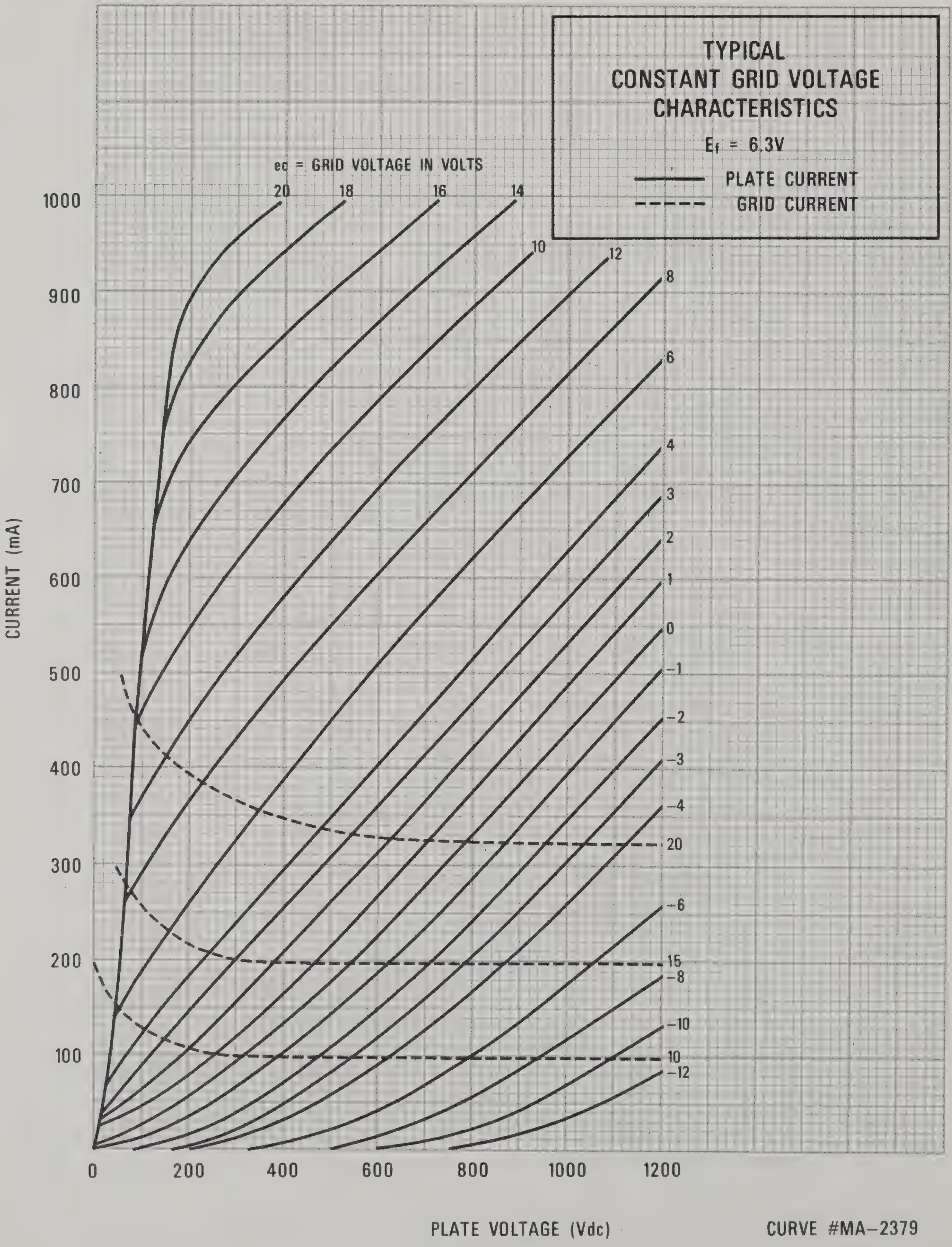


CURVE #MA-2379

EIMAC
Division of Varian
SAN CARLOS
CALIFORNIA

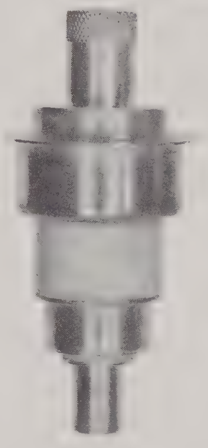
7815AL
7815RAL

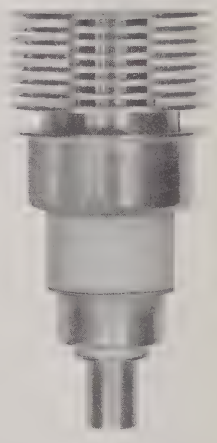
PLANAR TRIODES

The EIMAC 7815AL and 7815RAL are ceramic/metal planar triodes specially processed and tested to assure high reliability in airborne service. Evaluation of these tubes is based upon operating conditions in grid- or plate-pulsed oscillator service (transponder) and in grid- or plate-pulsed amplifier service in distance measuring equipment (DME). The testing emphasizes cathode emission capability at reduced heater voltage and high voltage hold-off, both features which are demanded in airline service.

The 7815AL is derived from the 7815/3CPN10A5 and the 7815RAL from the 7815R/3CPX100A5. These new improved tubes also contain the features of the original types, including rugged ceramic/metal construction, low interelectrode capacitance, high transconductance and high mu. The longer grid-anode ceramic insulator of the earlier type is used, making the 7815AL and 7815RAL tubes especially suited for high altitude airborne operation.

In addition to these features, these tubes also incorporate the arc-resistant cathode which assures stable operation under adverse conditions and which minimizes catastrophic failure due to arc-over during circuit malfunction. Both tubes are useable from dc to 3 GHz.


7815AL


7815RAL

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Cathode: Oxide Coated, Unipotential		
Heater: Voltage	5.7 (±2%)	V
Current, at 5.7 volts	0.95	A
Transconductance (Average):		
I_b = 70 mAdc, E_b = 600 Vdc	25	mmhos
Amplification Factor (Average)	100	
Direct Interelectrode Capacitance (grounded cathode)[2], without heater voltage:		
Grid-Cathode	6.30	pF
Grid-Plate	1.98	pF
Plate-Cathode(maximum)	0.035	pF

---

1. Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.

2. Capacitance values are for a cold tube as measured in a special shielded fixture.

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MECHANICAL

Maximum Overall Dimensions:	
Length	2.701 in; 68.60 mm
Diameter (7815AL)	1.195 in; 30.35 mm
Diameter (7815RAL)	1.264 in; 32.11 mm
Net Weight (7815AL)	1.8 oz; 48 gm
Net Weight (7815RAL)	2.2 oz; 63 gm
Operating Position	Any
Maximum Operating Temperature:	
Ceramic/Metal Seals	250°C
Anode Core	250°C
Cooling (7815AL)	Conduction and Convection
Cooling (7815RAL)	Forced Air
Terminals	Special

RF POWER AMPLIFIER OR OSCILLATOR

Grid- or Plate-Pulsed

MAXIMUM RATINGS, ABSOLUTE VALUES

DC PLATE VOLTAGE	3500	VOLTS
PEAK PULSE PLATE VOLTAGE PLATE PULSED	4500	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
Grid negative to cathode	-700	VOLTS
Grid positive to cathode	250	VOLTS
PULSE PLATE CURRENT	3.0	AMPERE
PULSE GRID CURRENT	1.8	AMPERE
DC CATHODE CURRENT	125	MILLIAMPERES
AVERAGE PLATE DISSIPATION		
Conduction and Convection (7815AL)	10	WATTS
Forced Air Cooling(7815RAL)	45	WATTS
GRID DISSIPATION (Average)	2	WATTS
DUTY FACTOR 1	.0033	
PULSE DURATION 1	6	µs
FREQUENCY	3	GHz

1. For longer pulse duration or higher duty cycle, consult the nearest Varian Electron Tube and Device Group Sales Office, or the Product Manager, EIMAC Division of Varian, Salt Lake City, Utah, or San Carlos, California.

OPERATING CONDITIONS FOR THE 7815AL and 7815RAL in REPRESENTATIVE APPLICATION.

Grid-Pulsed Oscillator

Frequency	1.090	GHz
Heater Voltage	5.7	V
DC Plate Voltage	2000	Vdc
DC Grid Voltage	-75	Vdc
Peak Plate Current	1.1	a
Peak Grid Current	0.8	a
Pulse Duration	0.5	µs
Duty	0.001	
Useful Power Output (Approx.)	750	w

Plate-Pulsed Amplifier

Frequency	1.1	GHz
Heater Voltage	5.7	V
Peak Plate Pulse Voltage	2000	Vdc
DC Grid Voltage	-45	Vdc
Peak Plate Current	1.8	a
Peak Grid Current	1.0	a
Pulse Duration	3.5	µs
Duty	0.001	
Driving Power	300	w
Useful Power Output (Approx.)	1800	w
Gain	8	db
Plate Efficiency	50%	

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.	
Heater Current at 5.7 volts	0.87	1.02	A
Cut-off Bias 1	---	-25	V
Grid-Plate Capacitance2	1.85	2.10	pF
Grid-Cathode Capacitance2	5.60	7.00	pF
Plate-Cathode Capacitance	---	0.035	pF

1. Measured with 1 mA plate current and a plate voltage of 1000 Vdc.
2. Capacitance values as measured with a cold tube and in a shielded socket. When the cathode is heated to the proper temperature the grid-cathode capacitance will increase by approximately 1 pF due to thermal expansion of the cathode support.

APPLICATION

MECHANICAL

MOUNTING - The important dimensions of the tube are carefully controlled with respect to the reference surface as shown on the outline drawing. The reference surface is intended to serve as a tube stop and the location of the tube in the circuit should therefore be determined by this surface coming in positive contact with a precisely positioned member of the socket or cavity. Adherence to this practice will assure both mechanical and electrical interchangeability of all tubes of a given type. If a non-designated surface is used as a tube stop, faulty positioning of the tube in the cavity and possible incomplete electrical contact can result in improper tuning, reduced power output and damage to the cavity, tube or both. Contact surfaces, with reference to the designated tube stop are shown in the outline drawing. Electrical contact to the cathode, grid, anode and also the heater should be restricted to these designated contact areas.

Dimensions should never be taken from sample tubes. Dimensional changes due to normal variations in undimensioned surfaces may occur within the limits specified on the outline drawing. Use of nondesignated electrical contact surfaces might therefore result in incomplete contact or mechanical interference, causing changes in cavity tuning.

Electrical contact should be made by spring finger collets bearing against the previously described contact areas. If connections are employed which do not provide multiple contacts to the designated contact areas, concentration of RF current will result in loss of output power, especially at higher frequencies. The spring contacts used should exert a firm pressure without gouging the plated contact surface. This latter phenomena can result in loose particles of material which can cause arcing or unstable operation of the cavity.

If the tubes are used in applications which call for severe shock or vibration the tube may be clamped in place by the knob or radiator, exerting pressure only on this part of the tube and against the tube stop. No other portion of the tube should be subject to any clamping force. In particular, electrical contacts which utilize setscrews or rigid clamps should be avoided. Such contact schemes can distort the contact surfaces causing undue stress in the metal-to-ceramic seal area which may result in a vacuum leak. Soldered electrical connections can be made, however great care should be taken during the solder operation to avoid fracture of the seal area due to thermal shock. All contact surfaces should be kept clean to minimize losses.

COOLING - The EIMAC planar triodes are designed to operate at envelope and anode temperatures of up to the maximum rated value of 250°C. However, performance and long-term reliability of any component are improved when it is kept as cool as technically feasible. Therefore, it is recommended that sufficient cooling be provided to keep the anode and seal areas well below the specified maximum temperature, where long tube life and high reliability are of great importance.

The maximum plate dissipation of the 7815AL is 10 watts average power. This can be accomplished by conduction, natural convection or forced air convection cooling. The maximum plate dissipation of the 7815RAL in pulse service is 45 watts average and forced air cooling must be employed at that level. When forced air cooling is used, it is recommended that additional airflow, apart from that flowing through the radiator be used to cool the tube envelope and other tube terminals. A certain amount of conduction cooling is usually inherent in the contact finger configuration. It should be noted, however, that spring fingers provide poor heat conduction and measurements have shown a temperature difference as much as 50°C between the contact finger and contact area.

It is suggested that in all new applications the envelope temperature be measured, especially if the tube is used close to the upper temperature limit. The temperature can easily be determined by the use of Tempilaq paint (Tempil Division, Big Three Industrial Gas & Equipment Co., Hamilton Blvd., So. Plainfield N.J. 07080) or Temp-Plate stickers (Pydrodyne, Inc., 1001 Colorado, Santa Monica, Calif. 90404)

ELECTRICAL

HEATER VOLTAGE - The rated heater voltage for either tube type is 5.7 volts and should be controlled within ±2% to obtain maximum tube life and to minimize variations in circuit performance.

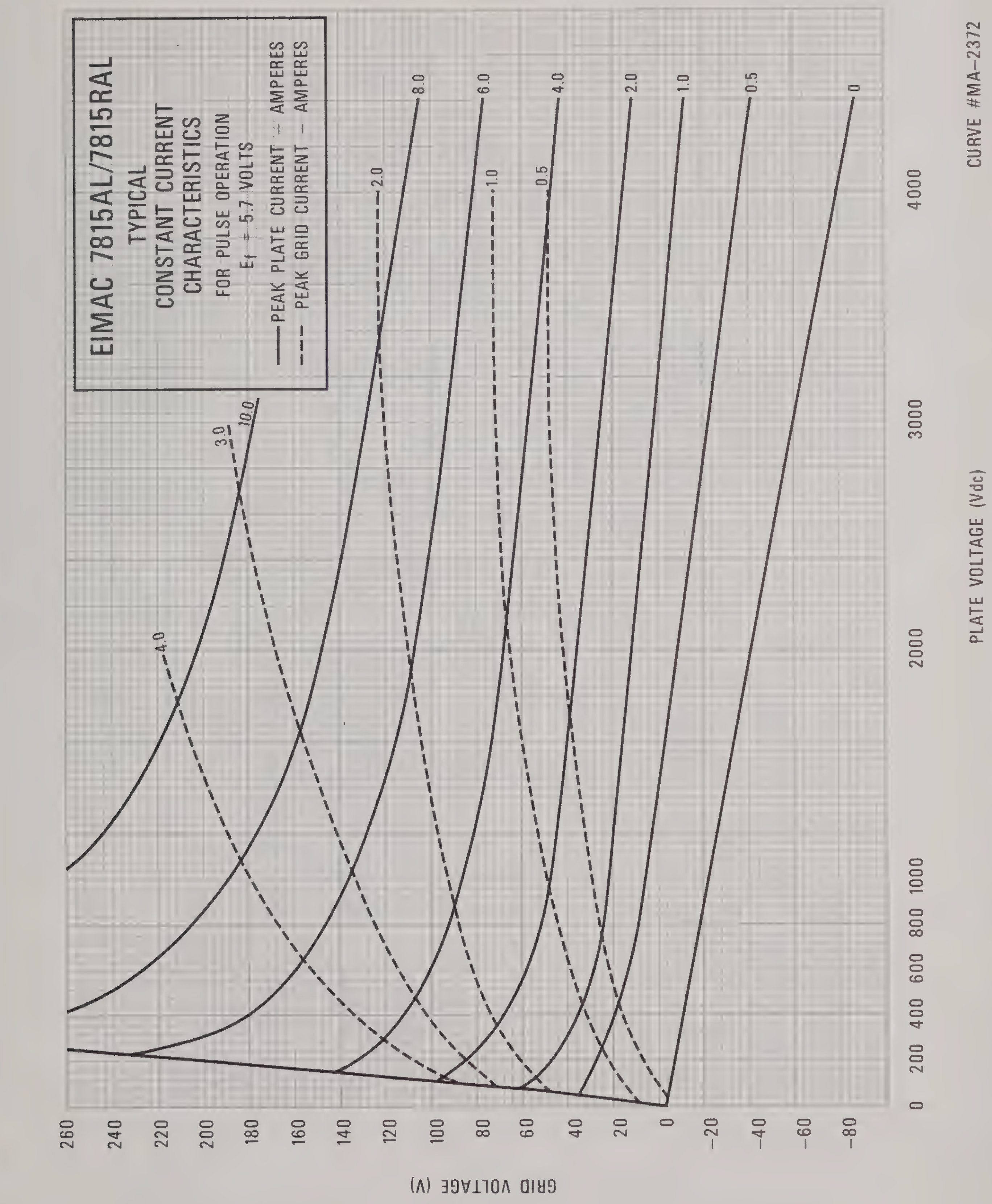
The rated heater voltage is optimum for most existing airborne applications such as DME and transponder systems. However, there are other applications where a different heater voltage than the nominal should be used to obtain the longest possible tube life. Depending on pulse width, power output and frequency of oscillation used a different heater voltage may be better for long reliable life. Electron transit time is not necessarily small with respect to the period of oscillation and the amount of driving power diverted will contribute to the cathode heating by electron bombardment.

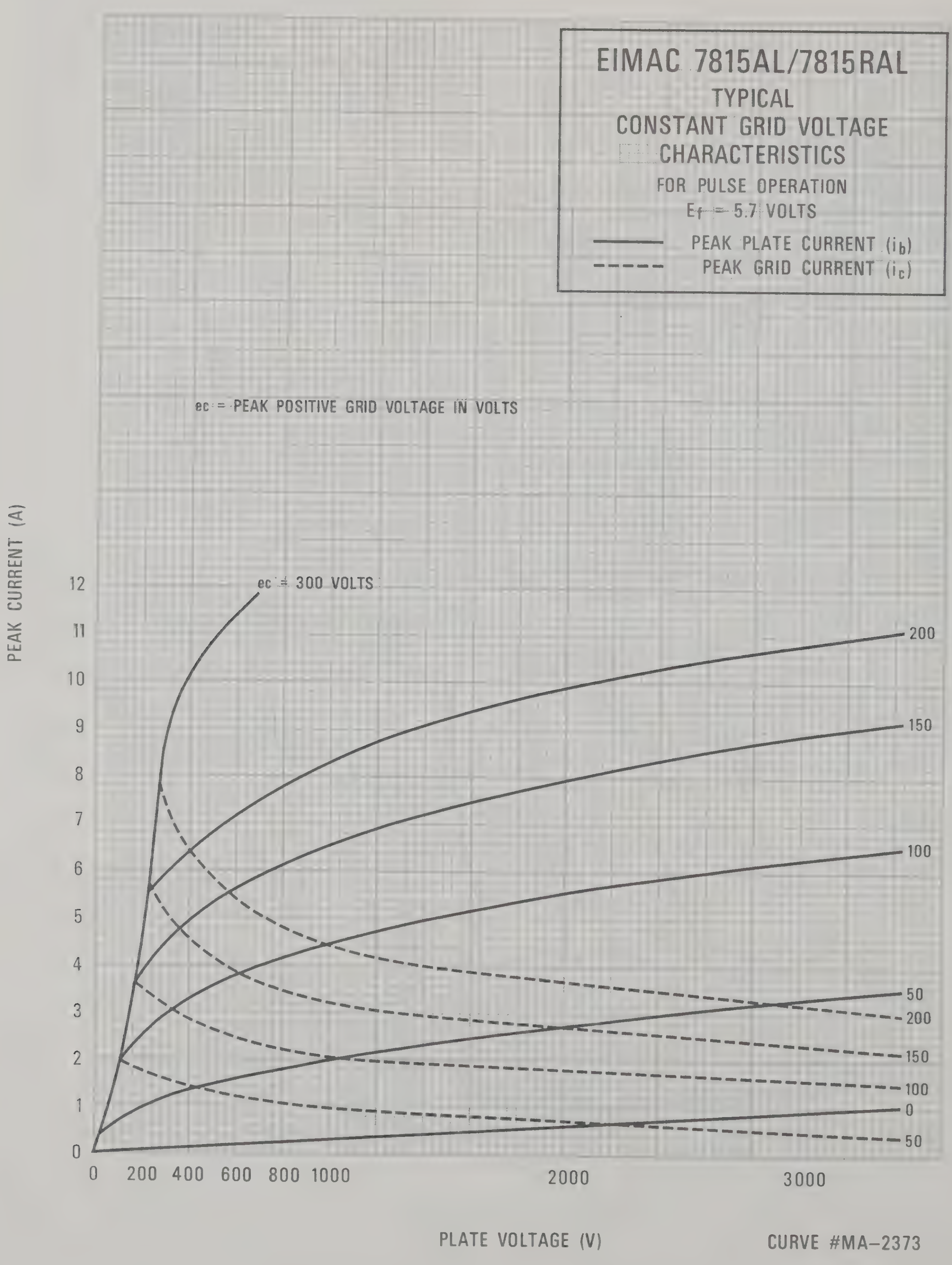
The proper adjustment of the heater voltage must be made to compensate for this additional heating, which depends on operating frequency and duty cycle employed.

INTERELECTRODE CAPACITANCES - As indicated, the capacitance values are shown for measurements made with no heater voltage. The cathode to grid and cathode to plate capacitance will increase with the application of the heater voltage, due to the thermal expansion of the cathode support. Typically, the increase in the grid to cathode capacitance will be 15%, or more, depending on the heater voltage. Since the heater voltage can vary depending on use, data taken without heater voltage is more useful for control of tube-to-tube uniformity. The grid to anode capacitance is not effected by the application of the heater voltage.

CIRCUIT TUNING - Especially under grid pulse conditions, it is important that the tube does not lose bias or momentarily go into a CW mode. Either of these events may result in tube failure. It is suggested that provision be made for initial circuit tune-up at reduced anode voltage and for extra tube protection when the circuit adjustment is critical. The average grid dissipation capability of these tubes is 2.0 watts. For many applications the limiting factor is often not anode dissipation or cathode emission capability, but grid dissipation. If pulse width control is lost in pulse applications the grid can exceed safe operating temperatures in 50 ms or less. Appropriate circuit protection during tune up is therefore recommended.

CATHODE OPERATION - The 7815AL and 7815RAL contain an arc-resistant cathode. Performance in the field and laboratory indicates these tubes are capable of withstanding some abuse due to high voltage arcs, however, poor circuit adjustment in the field may result in shortened tube life. It is, therefore, suggested that wherever feasible, the plate supply be designed such that its impedance limits the short circuit current to within five to ten times the maximum forward current. For pulse service the peak current should be limited to the values listed. Higher pulse width and duty cycles than given can be obtained with proper derating of the current. For this and special applications it is recommended that the user request additional information pertaining to his special application from the nearest Varian Electron Tube and Devices Field Office, or the Product Manager, Eimac Division of Varian, Salt Lake City, Utah or San Carlos, California.


EIMAC 7815AL/7815RAL
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
FOR PULSE OPERATION
Ef = 5.7 VOLTS
——PEAK PLATE CURRENT — AMPERES
– – – PEAK GRID CURRENT — AMPERES
10.0
8.0
6.0
4.0
2.0
1.0
0.5
0
4.0
3.0
2.0
1.0
0.5
260
240
220
200
180
160
140
120
100
80
60
40
20
0
−20
−40
−60
−80
GRID VOLTAGE (V)
0
200
400
600
800
1000
2000
3000
4000
PLATE VOLTAGE (Vdc)
CURVE #MA-2372



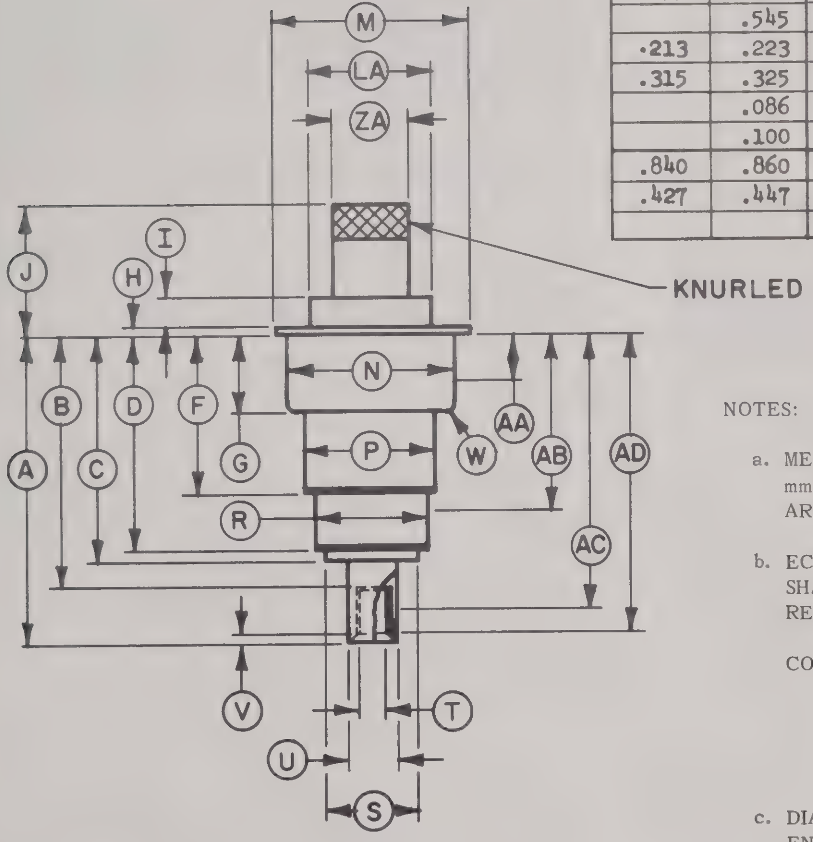
CURVE #MA–2373

ELECTRODE CONTACT AREA

DIM	MIN.	MAX.	MIN.	MAX.
AA	.035	.361	.89	9.17
AB	1.185	1.265	30.10	32.14
AC	1.534	1.728	38.96	43.89
AD	1.475	1.815	37.47	46.10
	DIM. IN INCHES		DIM. IN MILLIMETERS	

DIMENSION DATA

DIM. IN INCHES			DIM. IN MILLIMETERS		
MIN.	MAX.	DIM	MIN.	MAX.	NOTES
1.185	1.875	A	46.10	47.62	
	1.534	B		38.96	
	1.475	C		37.46	
1.289	1.329	D	32.74	33.76	
.970	1.010	F	24.64	25.65	
.462	.477	G	11.73	12.12	
	.040	H		1.02	
	.185	I		4.70	
.766	.826	J	19.46	20.98	
1.180	1.195	M	29.97	30.35	
1.025	1.035	N	26.04	26.29	c
.752	.792	P	19.10	20.12	d
.655	.665	R	16.64	16.89	c
	.545	S		13.84	
.213	.223	T	5.41	5.66	c
.315	.325	U	8.00	8.26	c
	.086	V		2.18	
	.100	W		2.54	
.840	.860	LA	21.34	21.84	
.427	.447	ZA	10.75	11.35	



7815 AL –

NOTES:

a. METRIC EQUIVALENTS, TO THE NEAREST .01 mm, ARE FOR GENERAL INFORMATION ONLY & ARE BASED UPON 1 inch = 25.4 mm.

b. ECCENTRICITY OF CONTACT SURFACES SHALL BE GAGED FROM CENTER LINE OR REFERENCE & SHALL BE AS FOLLOWS:

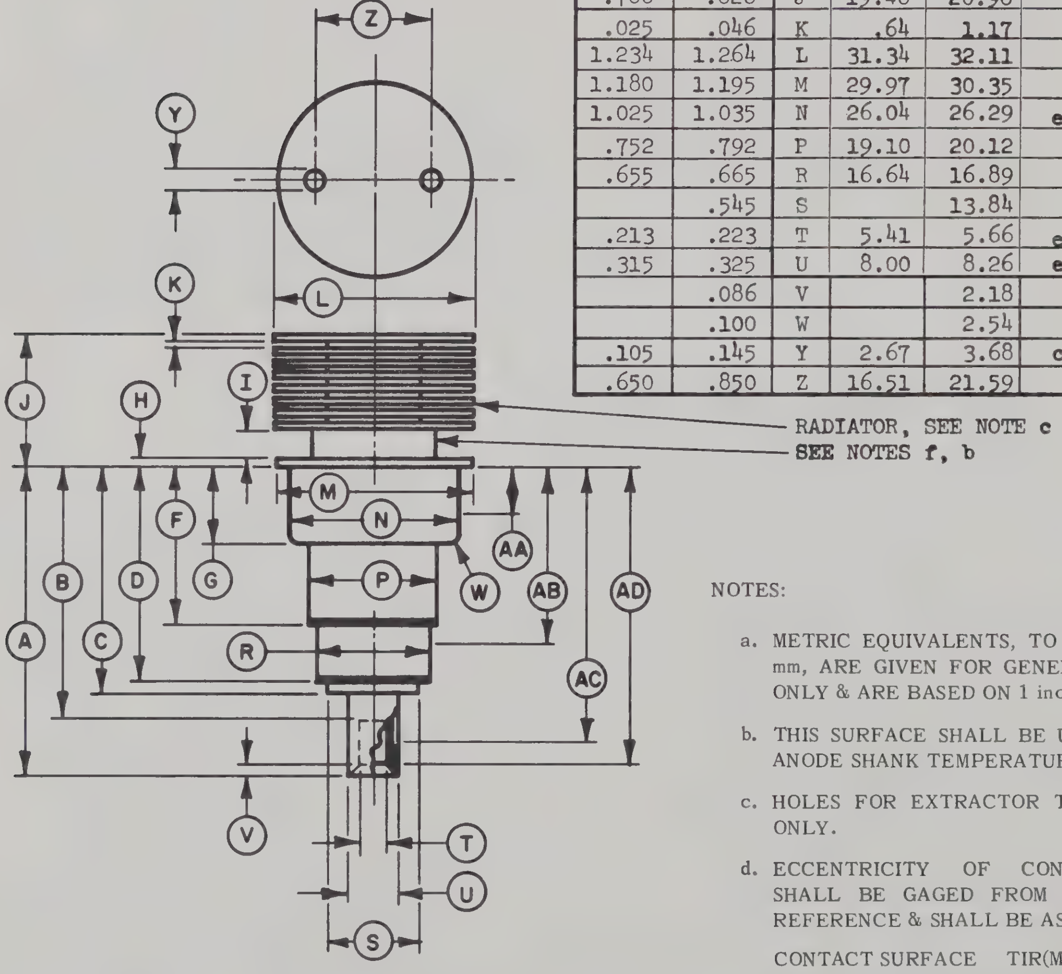
CONTACT SURFACE	TIR(MAX)	REFERENCE
ANODE	.020	CATHODE
GRID	.020	CATHODE
HEATER	.012	CATHODE

c. DIA'S N, R, T, & U SHALL APPLY THROUGHOUT ENTIRE LENGTH AS DEFINED BY DIM'S AA, AB, AC & AD RESPECTIVELY.

d. THIS SURFACE SHALL NOT BE USED FOR CLAMPING OR LOCATING.

ELECTRODE CONTACT DIMENSION				
DIM	MIN.	MAX.	MIN.	MAX.
AA	.035	.361	.89	9.17
AB	1.185	1.265	30.10	32.14
AC	1.534	1.728	38.96	43.89
AD	1.475	1.815	37.47	46.10
	DIM. IN INCHES		DIM. IN MILLIMETERS	

DIMENSION DATA					
DIM. IN INCHES			DIM. IN MILLIMETERS		
MIN.	MAX.	DIM	MIN.	MAX.	NOTES
1.185	1.875	A	46.10	47.62	
	1.534	B		38.96	
	1.475	C		37.46	
1.289	1.329	D	32.74	33.76	
.970	1.010	F	24.64	25.65	
.462	.477	G	11.73	12.12	
	.040	H		1.02	
.125	.185	I	3.18	4.70	
.766	.826	J	19.46	20.98	
.025	.046	K	.64	1.17	
1.234	1.264	L	31.34	32.11	
1.180	1.195	M	29.97	30.35	
1.025	1.035	N	26.04	26.29	e
.752	.792	P	19.10	20.12	
.655	.665	R	16.64	16.89	
	.545	S		13.84	
.213	.223	T	5.41	5.66	e
.315	.325	U	8.00	8.26	e
	.086	V		2.18	
	.100	W		2.54	
.105	.145	Y	2.67	3.68	c
.650	.850	Z	16.51	21.59	



7815 RAL

NOTES:

a. METRIC EQUIVALENTS, TO THE NEAREST .01 mm, ARE GIVEN FOR GENERAL INFORMATION ONLY & ARE BASED ON 1 inch = 25.4 mm.

b. THIS SURFACE SHALL BE USED TO MEASURE ANODE SHANK TEMPERATURE.

c. HOLES FOR EXTRACTOR THROUGH TOP FIN ONLY.

d. ECCENTRICITY OF CONTACT SURFACES SHALL BE GAGED FROM CENTER LINE OF REFERENCE & SHALL BE AS FOLLOWS:

CONTACT SURFACE	TIR(MAX)	REFERENCE
ANODE	.020	CATHODE
GRID	.020	CATHODE
HEATER	.012	CATHODE

e. DIA'S N, R, T & U SHALL APPLY THROUGHOUT ENTIRE LENGTH AS DEFINED BY DIM'S AA, AB, AC & AD RESPECTIVELY.

f. THIS SURFACE SHALL NOT BE USED FOR CLAMPING OR LOCATING.

EIMAC
Division of Varian
SAN CARLOS
CALIFORNIA

8755

UHF TRIODE

The EIMAC 8755 is a miniature, frequency-stable, planar triode for advanced airborne and space applications up to 3000 MHz at full ratings. The rugged ceramic/metal pulse tube is designed for high-voltage, high-pulse current operation, and features large contact areas for improved electrical paths. The tube may be used as an amplifier or an oscillator, and employs an arc-resistant cathode.

GENERAL CHARACTERISTICS

ELECTRICAL

	Min.	*Nom.*	*Max.*	
Cathode: Arc Resistant Oxide				
Heating Time	60			seconds
Heater: Voltage		6.3		volts
Current at 6.3 V	1.2	1.3	1.4	amps
Amplification Factor		125		
Transconductance Ib 105 mA		40,000		umhos
Direct Interelectrode Capacitances:				
Grid-Cathode		9.3		pF
Plate-Cathode		.06		pF
Grid Plate		1.25		pF
Frequency for Maximum Ratings		3000		MHz

MECHANICAL

Base	Graduated Cylindrical Surface
Operating Position	Any
Maximum Operating Temperatures:	
Ceramic-to-Metal Seals	250°C
Anode Core	250°C
Cooling	Conduction or forced air*
Maximum Over-All Dimensions:	
Height	1.47 inches
Diameter	0.83 inches
Net Weight	.67 ounce
Shipping Weight (approx.)	5.5 ounces

*With suitable cooler attached

(Effective 9-15-67) © 1967 by Varian

Printed in U.S.A.

GRID PULSED OSCILLATOR OR AMPLIFIER

MAXIMUM RATINGS

DC PLATE VOLTAGE	8000	VOLTS
DC GRID VOLTAGE	–150	VOLTS
PULSE PLATE CURRENT	5	AMPS
PLATE DISSIPATION*	150	WATTS**
GRID DISSIPATION*	1.5	WATTS
PULSE DURATION	6	uSEC****
DUTY	.0033	****

TYPICAL OPERATION

Frequency	1600	3000	3400	MHz
DC Plate Voltage	4000	4000	5000	Volts
DC Grid Voltage	–53	–75	–100	Volts
Pulse Plate Current	2.0	5	5	Amp
Pulse Power Output***	3.4	6	7	kW
Driving Power***	220	1350	1850	Watts
Pulse Duration	200	2	2	usec
Duty	.01	.001	.001	

PLATE PULSED OSCILLATOR OR AMPLIFIER

MAXIMUM RATINGS

PEAK PULSE PLATE VOLTAGE	10,000	VOLTS
DC OR PULSE GRID VOLTAGE	–150	VOLTS
PULSE PLATE CURRENT	5	AMPS
PLATE DISSIPATION (AVG.)	150	WATTS**
GRID DISSIPATION (AVG.)	1.5	WATTS
PULSE DURATION	6	uSEC****
DUTY FACTOR	.0033	****

PULSE MODULATOR OR PULSE AMPLIFIER (REGULATOR)

MAXIMUM RATINGS

DC PLATE VOLTAGE	8,000	VOLTS
PEAK PLATE VOLTAGE	10,000	VOLTS
DC OR PULSE GRID VOLTAGE	–150	VOLTS
PULSE PLATE CURRENT	5	AMPS
PLATE DISSIPATION (AVG.)	150	WATTS**
GRID DISSIPATION (AVG.)	1.5	WATTS
PULSE DURATION	6	uSEC ****
DUTY FACTOR	.0033	****

*Average
**With suitable cooler attached
***Measured
****For above plate current

APPLICATION

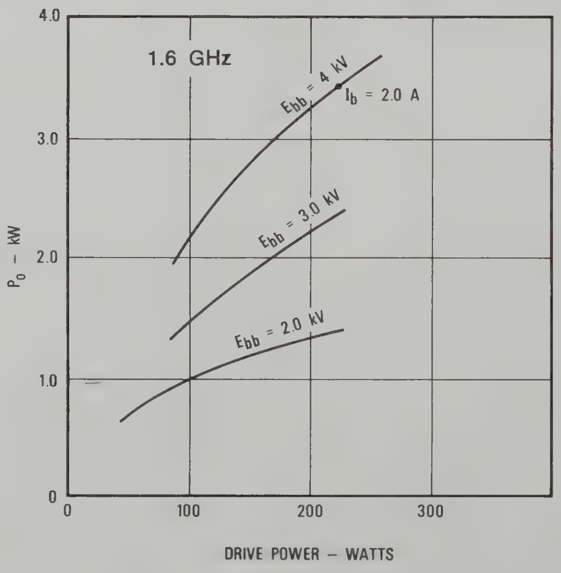
Cooling — The 8755 may be cooled by conduction or forced air.

Where forced air cooling is required, Anode Cooler, PN-014653 can be supplied. This cooler will be satisfactory for anode dissipation up to 150 watts with the proper air stream.

Special Applications — For further information, check with the nearest Varian Electron Tube and Device Field Office, or the Product Manager, Power Grid Division, EIMAC Division of Varian, 301 Industrial Way, San Carlos, California.

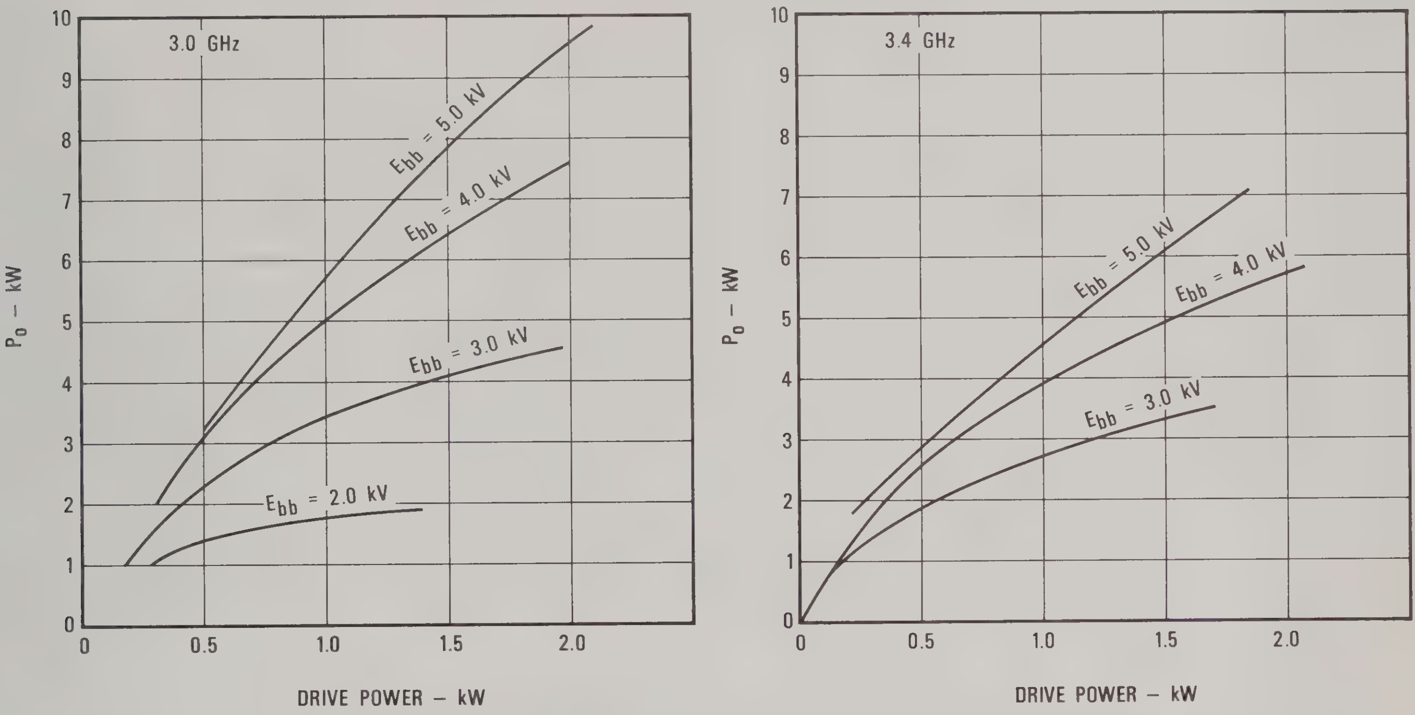
TYPICAL PERFORMANCE
8755 GRID PULSED AMPLIFIER

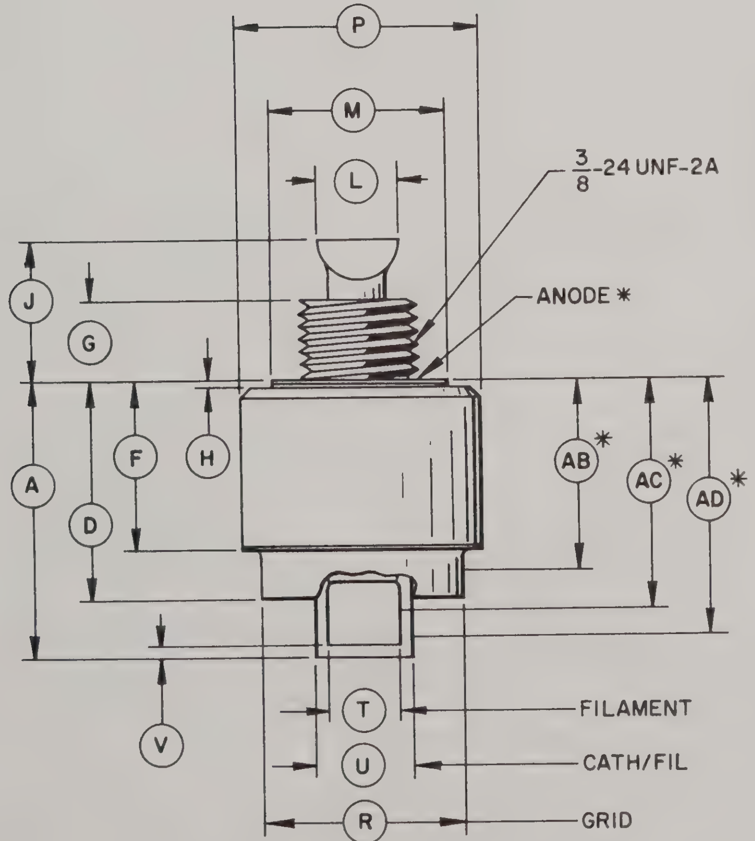
(PULSE DURATION 200 MICROSECONDS – DUTY .01)



TYPICAL PERFORMANCE
8755 GRID PULSED AMPLIFIER

(PULSE DURATION 2 MICROSEC – DUTY .001)





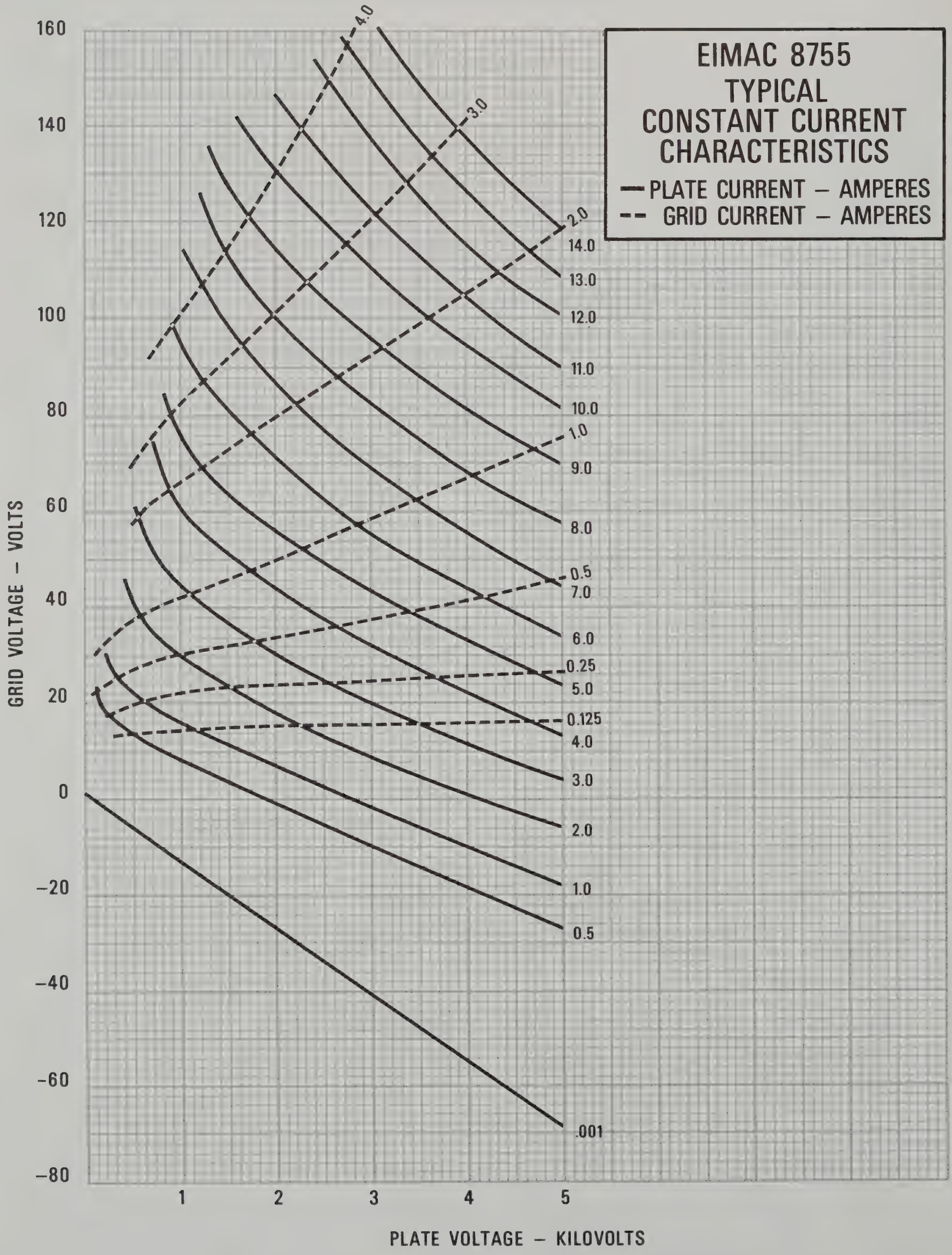
DIMENSIONS IN INCHES

DIMENSIONAL DATA

DIM.	MIN.	MAX.	REF.
A		1.020	
D	.760	.800	
F		.570	
G	.250	.270	
H		.040	
J		.450	
L		.260	
M	.550	.575	
P	.770	.830	
R	.650	.670	
T	.210	.225	
U	.310	.330	
V		.040	
AB	.590	.740	
AC	.760	.885	
AD	.800	.975	

NOTES

1. REF. DIMS. ARE FOR INFO. ONLY AND ARE NOT REQ'D. FOR INSPECTION PURPOSES.
2. (✱) CONTACT SURFACE.
3. ANODE FLANGE IS ELECTRICAL CONTACT. STUD IS FOR HEAT TRANSFER.


EIMAC 8755
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
PLATE CURRENT – AMPERES
GRID CURRENT – AMPERES
GRID VOLTAGE – VOLTS
PLATE VOLTAGE – KILOVOLTS
160
140
120
100
80
60
40
20
0
–20
–40
–60
–80
1
2
3
4
5
4.0
3.0
2.0
1.0
0.5
0.25
0.125
14.0
13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.5
.001

E I M A C
Division of Varian
SAN CARLOS
CALIFORNIA

8757

HIGH-MU PLANAR TRIODE

The 8757 is a miniature, frequency-stable, ceramic/metal, rugged planar triode for advanced airborne and space applications up to 3.5 GHz.

The 8757 may be used as an amplifier, oscillator, or frequency multiplier in the CW, grid- or plate-pulsed mode, as well as a modulator or regulator tube. In addition to low interelectrode capacitances, high transconductance and amplification factor, the 8757 has an anode designed to produce exceptional frequency stability and an arc-resistant cathode, both assuring stable, reliable and long-life operation under adverse conditions.

The 8757 is supplied without radiator and may be conduction, convection, heat sink, or liquid cooled. Radiators for forced-air cooling permitting an anode dissipation up to 150 watts, can be furnished on separate order.

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Cathode: Oxide Coated, Unipotential		
Heater: Voltage	6.3 ± 0.3	V
Current, at 6.3 volts	1.30	A
Transconductance (Average):		
$I_b = 160$ mA (200 mA/cm^2)	38	mmhos
Amplification Factor (Average):	75	
Direct Interelectrode Capacitances (Grounded Cathode)[2]		
Grid-Cathode	9.0	pF
Plate-Cathode	0.06	pF
Grid-Plate	1.65	pF
Cut-off Bias [3]	-30	V max.

---

1. Characteristics and operating values are based upon performance tests. These figures may change without notice as the results of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.

2. Capacitance values for a cold tube as measured in a special shielded fixture. When the cathode is heated to the proper temperature, the grid-cathode capacitance will increase from the cold value by approximately 1 pF due to thermal expansion of the cathode.

3. Measured with one milliampere plate current and a plate voltage of 1 kVdc.

(Effective 3-3-70) © 1969 by Varian Printed in U.S.A.

MECHANICAL

Maximum Overall Dimensions:

Length	1.30 in; 33.02 mm
Diameter	0.785 in; 19.94 mm
Net Weight	0.56 oz; 16 gm
Operating Position	Any

Maximum Operating Temperature:

Ceramic/Metal Seals	250 °C
Anode Core	250 °C
Cooling	Conduction, convection, forced-air[1] or liquid
Terminals	Coaxial, special

[1] Using one of the EIMAC radiators shown on the cooling curves.

ENVIRONMENTAL

Shock, 11 ms, non-operating	60 G
Vibration, operating, all axes 55 to 500 Hz	10 G
Altitude, max (in a suitably designed circuit)	70,000 ft.

CW RF POWER AMPLIFIER OR OSCILLATOR

MAXIMUM RATINGS/ABSOLUTE VALUES

DC PLATE VOLTAGE	2500	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
Grid negative to cathode	-400	VOLTS
Grid positive to cathode	30	VOLTS
DC PLATE CURRENT	250	MILLIAMPERES
DC GRID CURRENT	45	MILLIAMPERES
PLATE DISSIPATION[1]	150	WATTS
GRID DISSIPATION	1.5	WATTS
FREQUENCY	3.0	GIGAHERTZ

GRID PULSED OR PLATE PULSED AMPLIFIER OR OSCILLATOR

MAXIMUM RATINGS/ABSOLUTE VALUES

DC PLATE VOLTAGE (GRID PULSED)	3000	VOLTS
PEAK PULSE PLATE VOLTAGE (PLATE PULSED)	3500	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID CATHODE VOLTAGE		
GRID NEGATIVE TO CATHODE	-700	VOLTS
GRID POSITIVE TO CATHODE	175	VOLTS
PULSE PLATE CURRENT	5.0	AMPERES
PULSE GRID CURRENT	2.5	AMPERES
PLATE DISSIPATION[1]	150	WATTS
GRID DISSIPATION	1.5	WATTS
FREQUENCY	3.5	GIGAHERTZ
PULSE DURATION[2]	6	μsec
DUTY FACTOR[2]	.0033	

TYPICAL OPERATION

Grid-Pulsed r-f Power Oscillator (3.5 GHz)

DC Plate Voltage	2500	Vdc
Peak Plate Current	5.0	a
DC Grid Voltage Approx.	-70	V
Peak Grid Current	1.7	a
Filament Voltage	6.0	V
Useful Power Output Approx.	3000	w
Plate Efficiency	25%	

[1] Using one of the EIMAC radiators shown on the cooling curves.

[2] For application requiring longer pulse duration and/or higher duty cycle consult the nearest Varian Electron Tube and Devices Field Office, or the Product Manager, Eimac-Division of Varian, Salt Lake City, Utah.

PULSE MODULATOR OR PULSE AMPLIFIER SERVICE

MAXIMUM RATINGS/ABSOLUTE VALUES

DC PLATE VOLTAGE	3000	VOLTS
PEAK PLATE VOLTAGE	3500	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
Grid negative to cathode	-750	VOLTS
Grid positive to cathode	150	VOLTS
PULSE CATHODE CURRENT	7.5	AMPERES
DC PLATE CURRENT	150	MILLIAMPERES
PLATE DISSIPATION[1]	150	WATTS
GRID DISSIPATION	1.5	WATTS
PULSE DURATION[2]	6	μs
DUTY FACTOR[2]	.0033	
CUT-OFF MU	60	

1. Using one of the EIMAC radiators shown on the cooling curves.

2. For application requiring longer pulse duration and/or higher duty cycle consult the nearest Varian Electron Tube and Device Field Office, or the Product Manager Eimac-Division of Varian, Salt Lake City, Utah.

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.	
Heater: Current at 6.3 volts	1.20	1.40	A
Cathode Heating Time	60	---	sec.
Interelectrode Capacitances[1] (grounded cathode connection)			
Grid-Cathode	8.5	9.5	pF
Plate-Cathode	---	0.06	pF
Grid-Plate	1.5	1.8	pF

1. Capacitance values for a cold tube as measured in a special shielded fixture. When the cathode is heated to the proper temperature, the grid-cathode capacitance will increase from the cold value by approximately 1 pF due to thermal expansion of the cathode.

APPLICATION

COOLING - The 8757 can be cooled by conduction, convection, forced-air or liquid cooling. The tube is designed to permit high-temperature operation up to the limit indicated. However, if long life is the prime objective, tube terminal and seal temperatures should be kept well below 250°C. If forced-air cooling is provided, auxiliary air flow, apart from the air flowing through the radiator, should be provided to cool the tube envelope and other tube terminals. Some conduction cooling is always provided through the contact terminals. However, these terminals usually exhibit poor heat transfer, often having a temperature gradient across them as high as 50° C. Cooling curves are given for the three radiators which are suitable for use with the 8757.

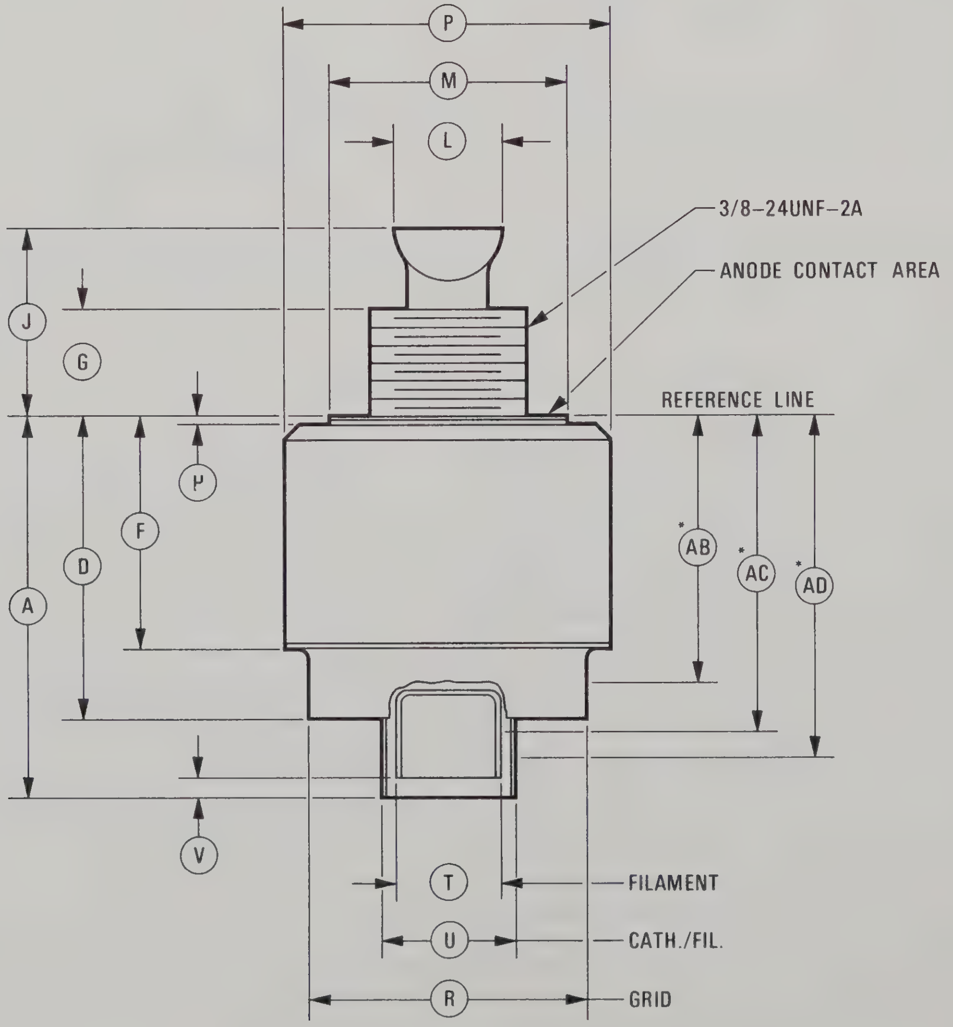
For operating information refer to EIMAC bulletin #15, "Operating Data for Planar Triodes."

DIMENSIONAL DATA				
DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A		.950		24.13
D	.690	.730	17.53	18.54
F		.500		12.70
G	.150	.170	3.81	4.32
H		.040		1.02
J		.350		8.89
L		.260		6.04
M	.545	.570	13.84	14.48
P	.775	.785	19.69	19.94
R	.650	.670	16.51	17.02
T	.210	.225	5.33	5.72
U	.310	.330	7.87	8.38
V		.040		1.02
(*) CONTACT SURFACES				
AB	.595* ±.075		15.11* ±1.91	
AC	.752* ±.062		19.10* ±1.57	
AD	.817* ±.087		20.75* ±2.21	

NOTES:

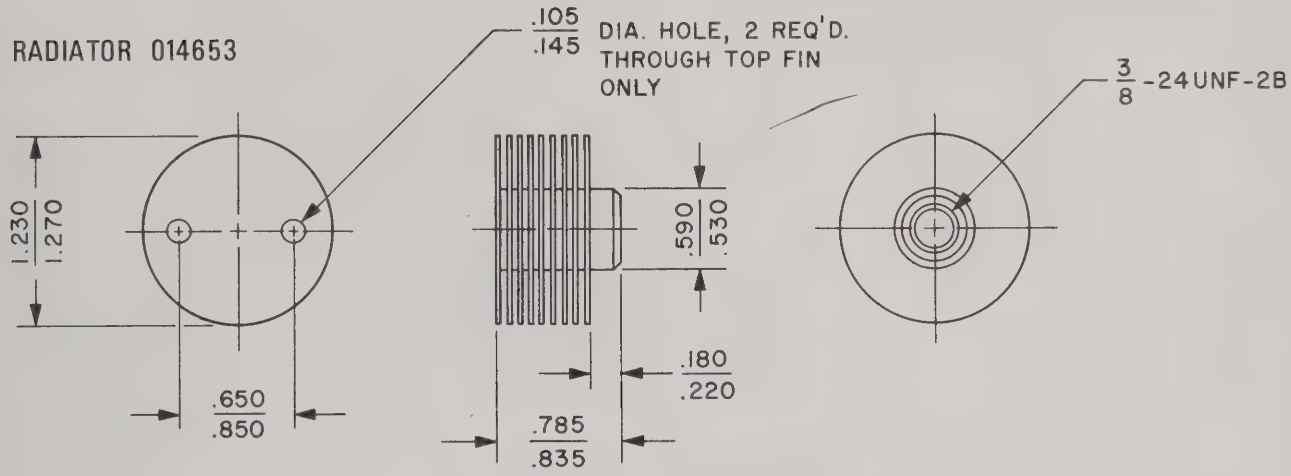
1. ANODE FLANGE IS ELECTRICAL CONTACT. STUD IS FOR HEAT TRANSFER.
2. (*) DISTANCE FROM REFERENCE SURFACE TO THE CENTER OF CONTACT AREA.
3. METRIC EQUIVALENTS ARE TO THE NEAREST .01 mm, ARE GIVEN FOR GENERAL INFORMATION ONLY, AND ARE BASED ON 1 INCH = 25.4 mm.
4. CONCENTRICITY BETWEEN GRID TERMINAL AND CATHODE/HEATER TERMINAL RESPECTIVELY TO THE ANODE STUD TO BE 0.020 TIR MAX. MEASUREMENT TO BE MADE WITH EIMAC GAGE JA-21685G WHICH MUST SEAT AGAINST THE ANODE FLANGE.

FIGURE 1

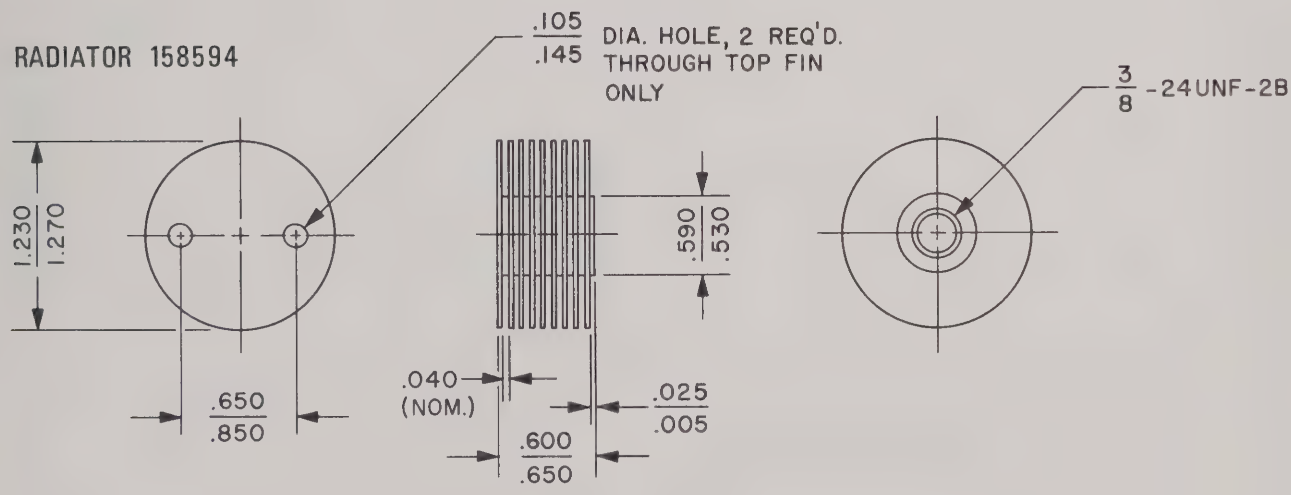


EIMAC RADIATORS

RADIATOR 014653



RADIATOR 158594



RADIATOR 158593

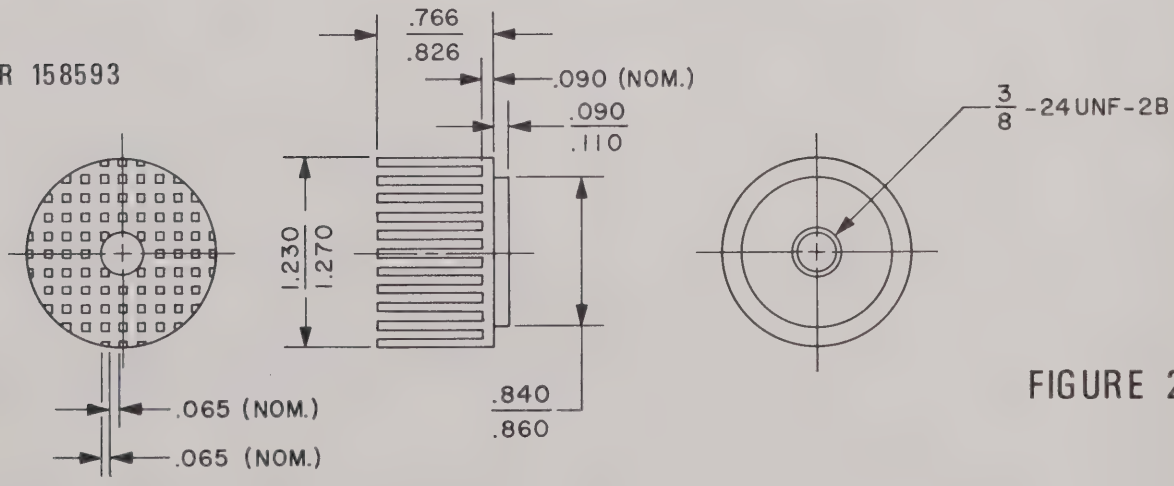


FIGURE 2

FIGURE 3

COMBINED CORRECTION FACTORS FOR INLET AIR TEMPERATURE AND ALTITUDE

(RELATIVE TO 25°C AND SEA LEVEL)

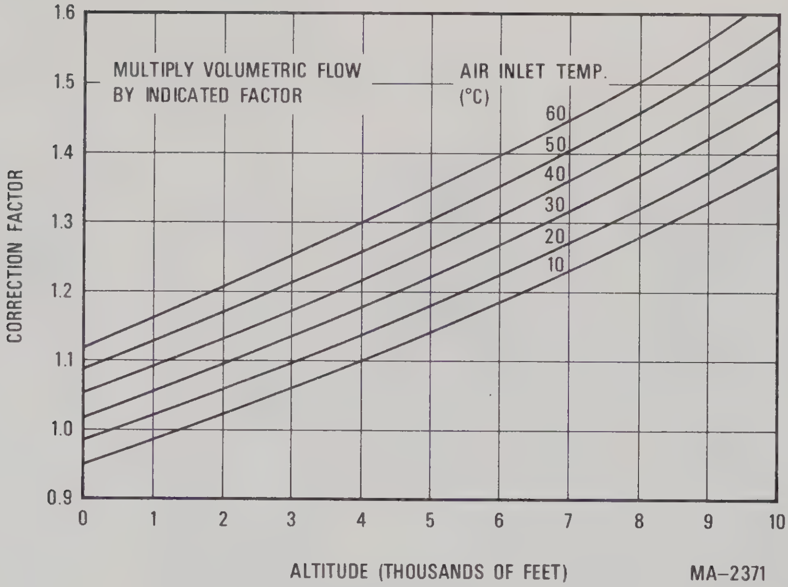
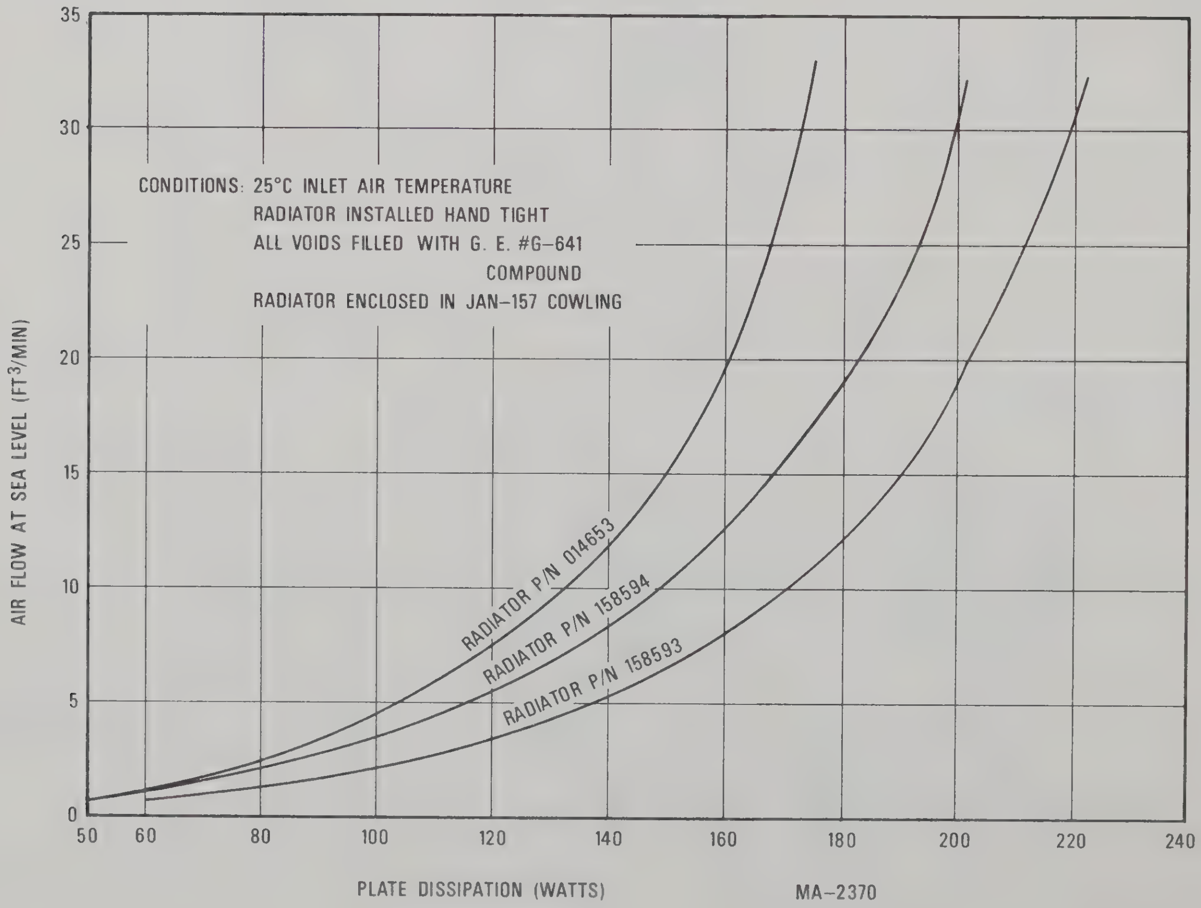
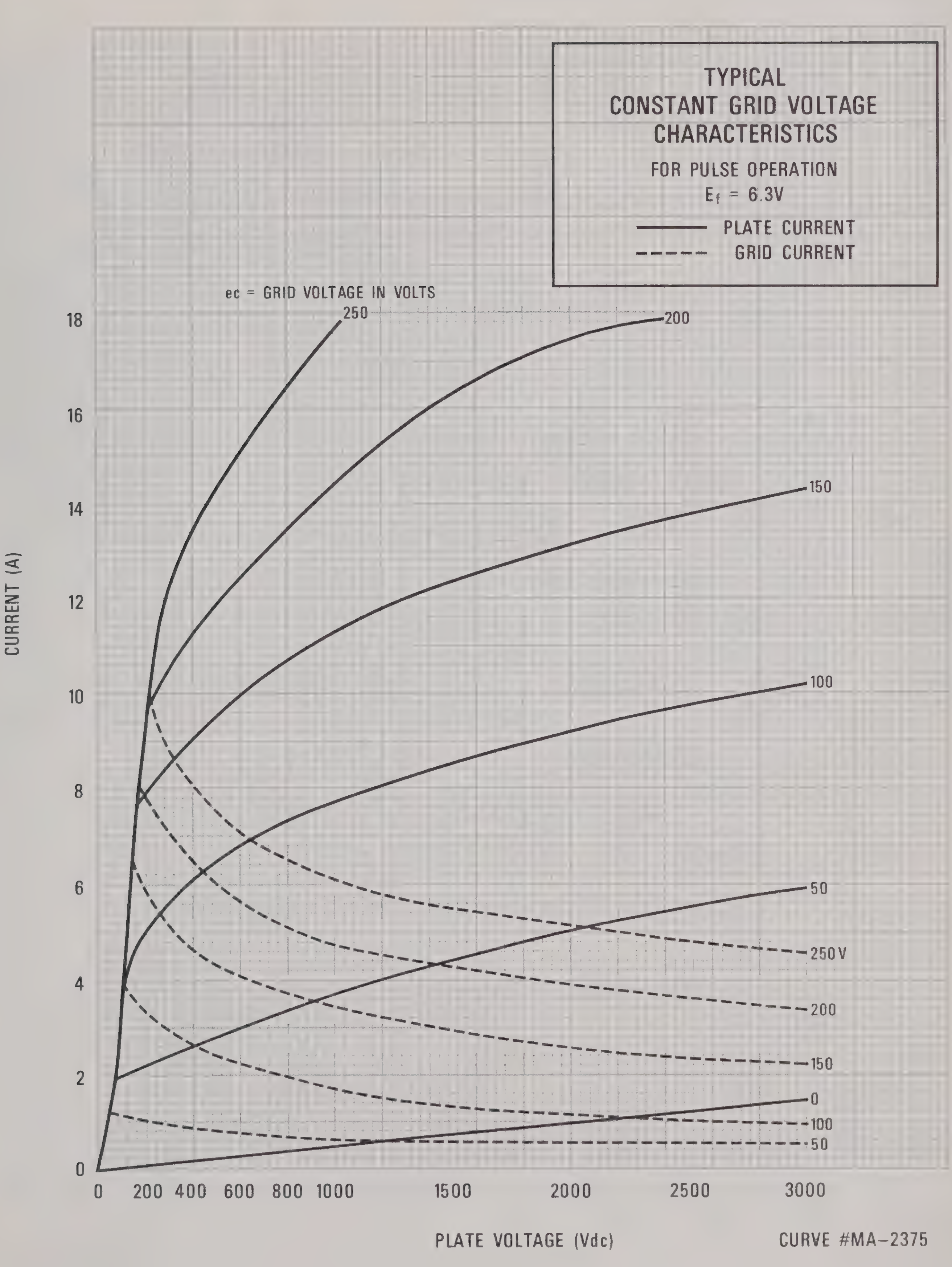
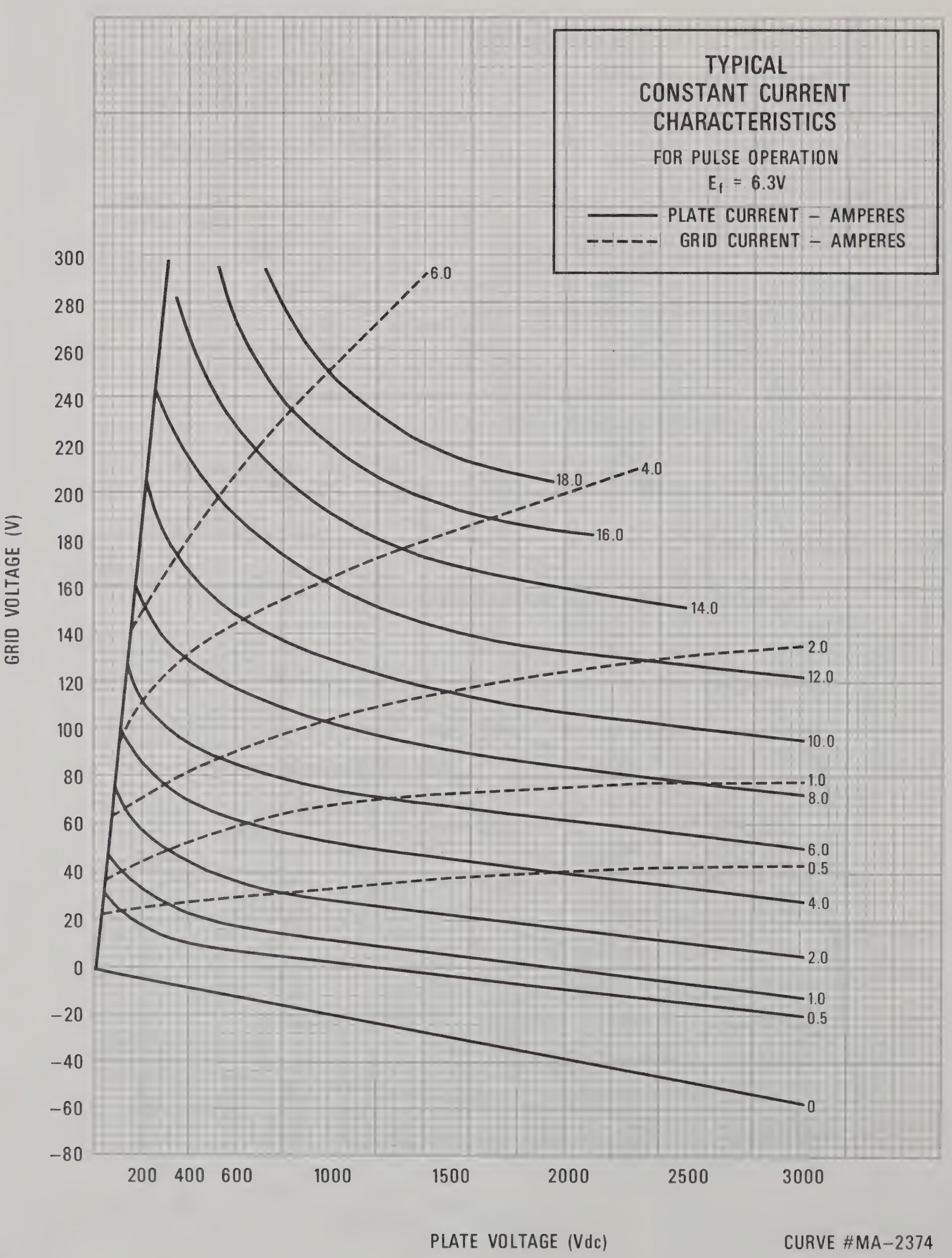


FIGURE 4

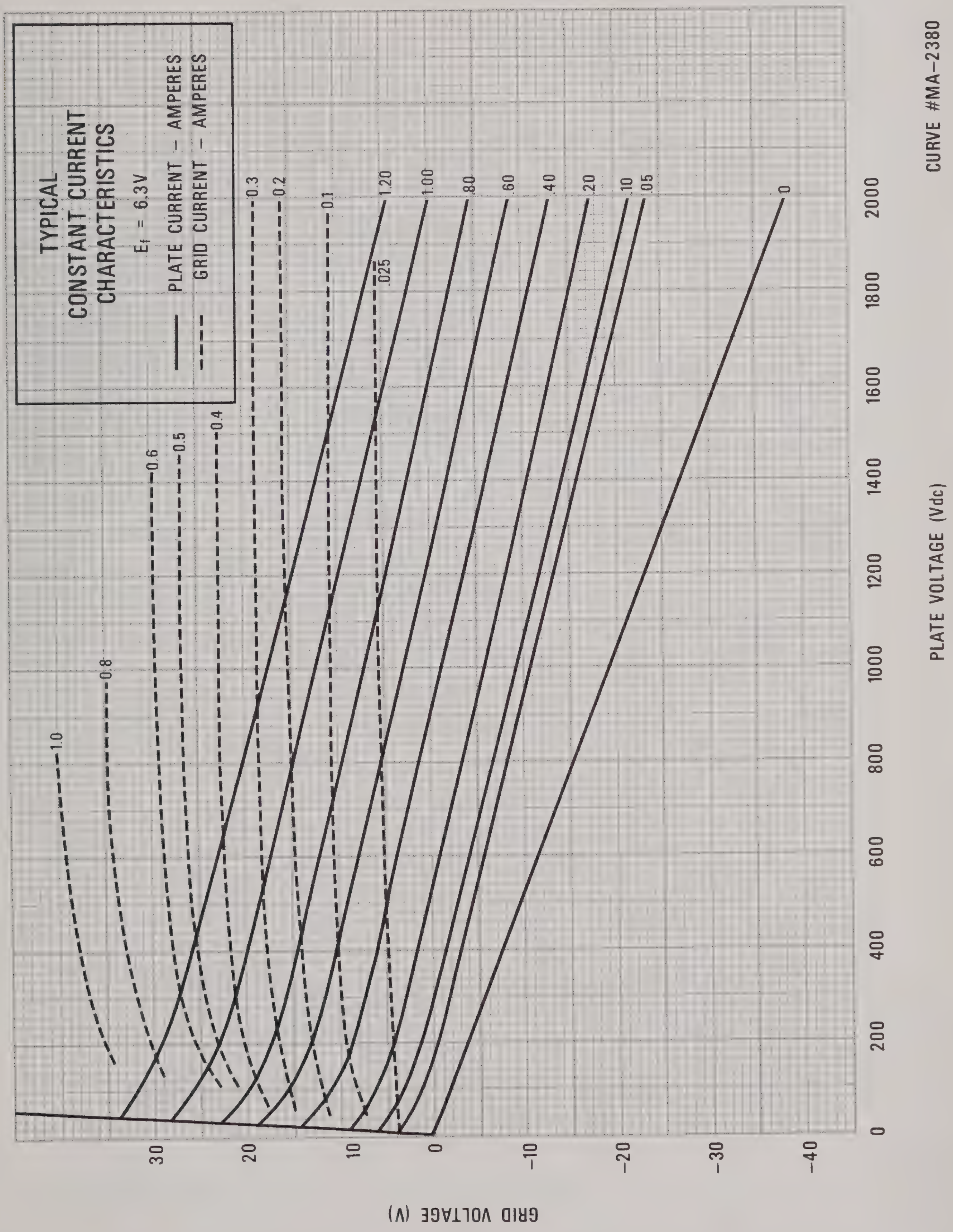
PLATE DISSIPATION VARIATION WITH COOLING AIR FLOW

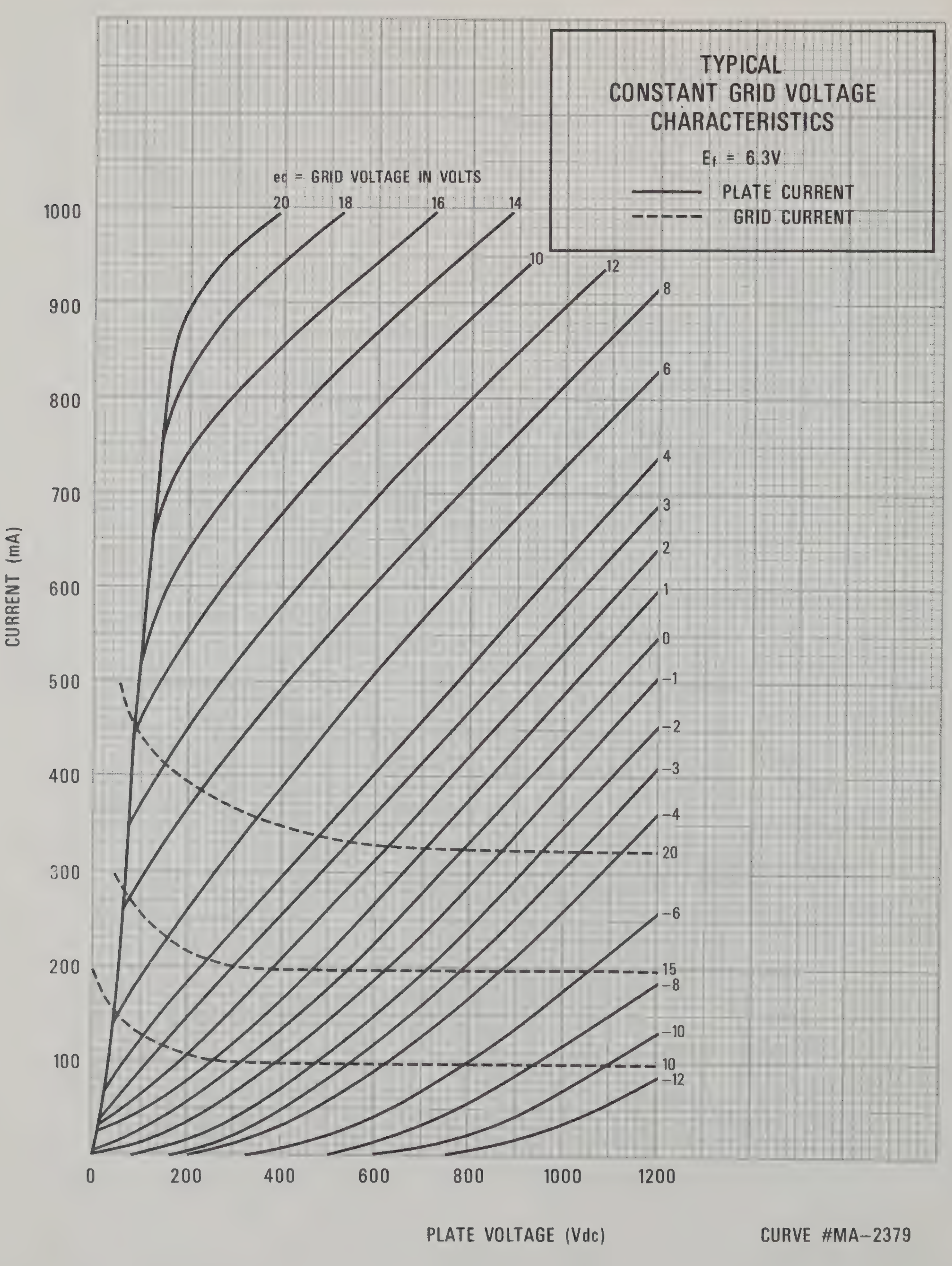



TYPICAL
CONSTANT GRID VOLTAGE
CHARACTERISTICS
FOR PULSE OPERATION
E_f = 6.3V
PLATE CURRENT
GRID CURRENT
ec = GRID VOLTAGE IN VOLTS
250
200
150
100
50
0
250V
200
150
100
50
CURRENT (A)
18
16
14
12
10
8
6
4
2
0
0
200
400
600
800
1000
1500
2000
2500
3000
PLATE VOLTAGE (Vdc)
CURVE #MA-2375



CURVE #MA-2374

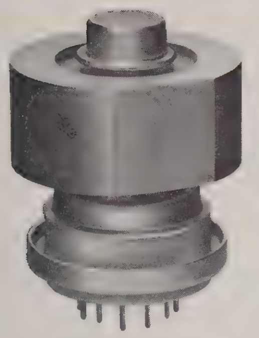

TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
E_f = 6.3V
PLATE CURRENT – AMPERES
GRID CURRENT – AMPERES
1.20
1.00
.80
.60
.40
.20
.10
.05
0
1.0
0.8
0.6
0.5
0.4
0.3
0.2
0.1
.025
GRID VOLTAGE (V)
30
20
10
0
-10
-20
-30
-40
PLATE VOLTAGE (Vdc)
0
200
400
600
800
1000
1200
1400
1600
1800
2000
CURVE #MA-2380

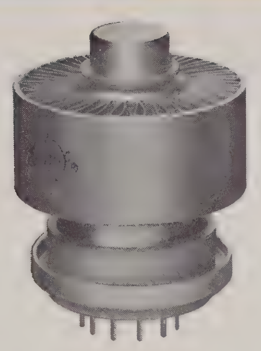


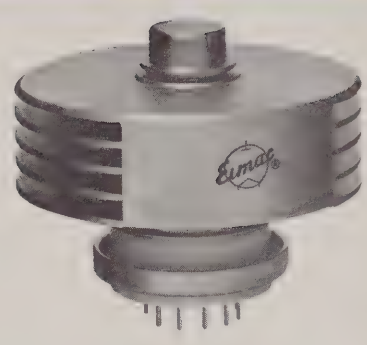
CURVE #MA-2379

TECHNICAL DATA

8873
8874
8875
HIGH-MU TRIODES


8873


8874


8875

The EIMAC 8873, 8874, and 8875 are compact external-anode, ceramic/metal triodes intended for use in zero-bias Class-B amplifiers in audio or radio-frequency applications. The three types differ only in method of cooling and anode dissipation: the anode of the 8873 is designed for conduction cooling and is nominally rated for 200 watts; the 8875 anode has a transverse cooler for forced-air cooling and is rated for 300 watts; and the 8874 requires axial-flow forced-air cooling and is rated for 400 watts. Operation with zero grid bias simplifies associated circuitry by eliminating the bias supply. In addition, grounded-grid operation is attractive since a power gain as high as twenty times can be obtained with these types in a cathode-driven circuit.

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Cathode: Oxide Coated, Unipotential		
Heater Voltage	6.3 ± 0.3	V
Heater Current, at 6.3 volts	3.2	A
Cathode-Heater Potential (maximum)	±150	V
Transconductance, average		
I_b = 250 mAdc	29,000	µmhos
Amplification Factor, average	160	
Direct Interelectrode Capacitances, (cathode grounded, in shielded fixture)[2]		
Cin	19.5	pF
Cout	0.03	pF
Cgp	7.0	pF
Direct Interelectrode Capacitances, (grid grounded, in shielded fixture)[2]		
Cin	19.5	pF
Cout	7.0	pF
Cpk	0.03	pF
Frequency of Maximum Rating:		
CW	500	MHz

1. Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.
2. Capacitance values are for a cold tube as measured in a special shielded fixture in accordance with Electronic Industries Association Stantard RS-191.

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MECHANICAL

Maximum Overall Dimensions:

	TYPE 8873	TYPE 8874	TYPE 8875
Length	2.26 in. 57.40 mm	2.26 in. 57.40 mm	2.26 in. 57.40 mm
Diameter	1.64 in. 41.66 mm	1.64 in. 41.66 mm	2.52 in. 64.01 mm
Net Weight	8.5 oz. 240.9 gm	4.3 oz. 121.9 gm	8.6 oz. 243.8 gm
Operating Position	Any	Any	Any

Cooling: (Type 8873)

Conduction cooled. Recommended Beryllium Oxide thermal link . . . . EIMAC SK-1920

(Type 8874)

Air flow at 50°C and sea level . . . . 8.6 ft^3/Min.

Pressure Drop, across tube anode cooler at 8.6 ft^3/Min. . . . . 0.37 in. H$_2$0

(Type 8875)

Air flow at 50°C and sea level . . . . 14 ft^3/Min.

Pressure Drop, across tube anode cooler at 14 ft^3/Min. . . . . 0.6 in. H$_2$0

Operating Temperature, Maximum, all three types,

Ceramic/Metal seals and Anode Core . . . . 250°C

Base: (all types) . . . . Large Wafer Elevenar 11-Pin with Ring (JEDEC No. E11-81)

Recommended Sockets . . . . E.F. Johnson #124-311-100
Erie #9802-000
Mycalex #CP464-2

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.	
Heater Current, at 6.3 volts	2.9	3.5	A
Cathode Warmup Time	60	---	sec.
Interelectrode Capacitances (cathode grounded, in shielded fixture)[1]			
Cin	18.0	21.0	pF
Cout	---	0.04	pF
Cgp	6.0	8.0	pF
Interelectrode Capacitances (grid grounded, in shielded fixture)[1]			
Cin	18.0	21.0	pF
Cout	6.0	8.0	pF
Cpk	---	0.04	pF

---

[1] Capacitance values are for a cold tube as measured in a special shielded fixture in accordance with Electronic Industries Association Standard RS-191.

RADIO FREQUENCY LINEAR AMPLIFIER CATHODE DRIVEN

Class AB2

MAXIMUM RATINGS:

DC PLATE VOLTAGE	2200	VOLTS
DC PLATE CURRENT	0.250	AMPERE
PLATE DISSIPATION (nominal values)		
TYPE 8873 (without heat sink)*	15	WATTS
TYPE 8874	400	WATTS
TYPE 8875	300	WATTS
GRID DISSIPATION	5	WATTS

* Rating in air. See Application Information for heat sink rating.

TYPICAL OPERATION

Class AB2 (Cathode driven) Peak Envelope Modulation Crest or Key-Down Conditions[1]

Frequency	30	150	432	MHz
Plate Voltage	2000	2000	2000	Vdc
Cathode Voltage	8.2	9.8	8.2	Vdc
Zero-Signal Plate Current	22	10	22	mAdc
Single-Tone IVS Plate Current[2]	500	400	500	mAdc
Two-Tone Plate Current[3]	312	245	300	mAdc
Single-Tone Grid Current[4]	30	23	98	mAdc
Two-Tone Grid Current[4]	12	10	39	mAdc
Peak rf Grid/Cathode Voltage[4]	67	50	67	v
Peak Driving Power[4]	26	17.5	27	w
Peak Power Input	1000	800	1000	W
Useful Output Power[4]	587	526	505	W
Resonant Load Impedance	2140	--	--	Ω
Intermodulation Distortion[5]				
3rd Order	-35	--	--	dB
5th Order	-36	--	--	dB

1. Short-term duty should not exceed 50%. During brief test periods, "on" time must be kept as short as possible, with sufficient "off" time to allow for tube cooling.
2. Key down conditions. With 50% duty, current will be half the value shown.
3. Two equal-tone modulation. During brief test periods, allow sufficient "off" time for tube cooling. Values will be lower with voice modulation for the same PEP level.
4. Approximate values.
5. The intermodulation distortion products are referenced against one tone of a two equal-tone signal.

RADIO FREQUENCY POWER AMPLIFIER OR OSCILLATOR

Class C Telegraphy or FM Telephony
(Key-Down Conditions)

MAXIMUM RATINGS:

DC PLATE VOLTAGE	2200	VOLTS
DC GRID VOLTAGE	-100	VOLTS
DC PLATE CURRENT	0.250	AMPERE
PLATE DISSIPATION (nominal values)		
TYPE 8873 (without heat sink)*	15	WATTS
TYPE 8874	400	WATTS
TYPE 8875	300	WATTS
GRID DISSIPATION	5	WATTS

* Rating in air. See Application Information for heat sink rating.

TYPICAL OPERATION (Frequencies to 110 MHz)

Plate Voltage	2000	Vdc
Grid Voltage[1]	-10	Vdc
Plate Current	250	mAdc
Grid Current[1]	40	mAdc
Measured Driving Power	9	W
Plate Input Power	500	W
Plate Dissipation	195	W
Useful Output Power	305	W

1. Approximate value.

APPLICATION

MOUNTING & SOCKETING - The 8873, 8874, and 8875 may be mounted in any position. Sockets such as E.F. Johnson #124-311-100, Erie #9802-000, Mycalex # CP464-2, or equivalent may be used as long as there are no unusual circumstances which would allow the ceramic/metal anode and base seal temperatures to exceed 250°C. The internal construction of these tubes is such that heat transfer to the tube base is minimized, but in operation there is some heat flow from the tube base to the socket. Mounting should be such that free movement of air past the base by convection is possible, or, if forced-air cooling is being provided for the anode, some of this air may be bled off to provide for some circulation past the tube base.

The 8873 mounting is normally controlled by its heat sink configuration and location. Where possible, the socket can be mounted on a bracket which in turn is mounted to the heat sink so that the one sink will act for removal of heat from the tube anode and also the tube base. The EIMAC SK-1920 beryllium oxide (BeO) thermal link is available for use between the 8873 anode and the heat sink. BeO is a ceramic material which exhibits high thermal conductance, similar to aluminum, and high electrical resistance and low loss typical of ceramics. Properly installed, it provides a low thermal resistance path allowing the anode heat to be transferred to the heat sink, while providing electrical isolation between the anode and the sink.

The 8874 requires forced-air cooling for its anode, which can often be accomplished most easily by means of a pressurized anode-compartment chassis, with air passing through the anode cooler and then exhausting. In such an installation, some air can be bled past the socket mount to provide base cooling if this is required.

The 8875 has a large transverse cooler on its anode, requiring forced-air cooling directed crossways. Maximum dissipation is realized with ducted air to the cooler, but operation at reduced dissipation levels is also possible with air supplied from a small general-purpose fan mounted in close proximity to direct air across the tube.

HEATER/CATHODE OPERATION - The rated heater voltage for the 8873, 8874, and 8875 is 6.3 volts, as measured at the base of the tube, and variations should be restricted to plus or minus 0.3 volt for long life and consistent performance. At frequencies above approximately 300 MHz it may be necessary to reduce heater voltage to compensate for rf transit-time heating of the cathode after dynamic operation of the tube has started. This back heating is a function of frequency, grid current, grid bias, anode current, duty cycle, and circuit design and adjustment. The following heater operating voltages are recommended:

Frequency (MHz)	Heater Voltage
300 or lower	6.3
301 to 400	6.0
401 to 500	5.7

The potential between the heater and the cathode should be limited to plus or minus 150 Vdc.

CATHODE WARMUP TIME - Anode voltage may be applied simultaneously with heater voltage, but a minimum of 60 seconds warmup time should be allowed before drive voltage is applied to the grid to allow proper conditioning of the cathode surface.

ANODE CURRENT RATING AND TUNEUP PROCEDURE - The 8873, 8874, and 8875 are rated for 250 mAdc of continuous anode current. In intermittent voice (A3J emission) and interrupted carrier keying (A1 emission) service, which would be normal single-sideband-suppressed-carrier or keyed CW operation, and where short-term duty does not exceed 50%, the dc anode current (per tube) may be 500 mA during the "on" time. With 50% duty, the average current (per tube) would be 250 mA. During very short test periods, the tubes may be operated at the full 500 mA value but care must be taken to keep the "on" time as short as possible, with sufficient "off" time to allow for tube cooling.

Initial tuneup should preferably be done with reduced anode voltage and drive, and if done at the correct values, little or no retuning will be necessary when switching to full operating level. For the 2000 volt Intermittent Voice Service (IVS) condition, tuneup is recommended at 1500 volts and reduced grid drive. When anode voltage and drive are then raised, the full one kilowatt PEP IVS condition will be achieved with little or no retuning required.

COOLING-8873 - This tube is designed for use in a conduction-cooled system by using a beryllium oxide (BeO) thermal link between the anode and the heat sink. The heat sink in turn can be cooled by natural (free) convection, forced-air convection, liquid cooling, or a combination of these methods. The design choice is determined by the tube application, but in all cases the cooling system must maintain the anode and the ceramic/metal seal temperatures below 250°C.

Intimacy of contact and pressure are two factors which will effect transfer of heat from the tube anode through the BeO thermal link to the heat sink. A good thermally conductive compound should be used in the interface (between anode and BeO, and between BeO and heat sink) to reduce the thermal resistance of the joint. Examples of commercially available thermal joint compound are:

WAKEFIELD 120 - Wakefield Engineering Co.,
Wakefield, Mass. 01880

DOW CORNING 340 - Dow Corning Corp., Midland, Michigan 48640
ASTRODYNE THERMAL BOND 312 - Astrodyne Inc., Burlington, Mass. 01803
G.E. INSULGREASE G641 - G.E. Company, Cleveland, Ohio 44117

The method of fastening the tube to the heat sink should provide reasonable compression to reduce interface thermal resistance. A device such as the DE-STA-CO toggle clamp, modified by replacing the rubber nose with a ½-inch ceramic insulator, can provide a simple means of holding the tube securely and providing adequate compression.

The EIMAC SK-1920 BeO thermal link is recommended for use between the tube anode and the heat sink, as it is the correct size and thickness to match the physical and electrical characteristics of the 8873 tube.

A heat sink capable of handling 200 watts of continuous dissipation from the 8873 can be made with a section of finned aluminum alloy extrusion, such as Wakefield A-2494, or equivalent, cut to approximately 8 inches by 4 inches, backed with a 1/8-inch copper plate the same size. Thermal joint compound is used between the copper plate and the flat aluminum surface, with the two secured together at enough points to assure good continuous contact. The backed extrusion is mounted so as to allow for free air convection around the fins. The tube is then mounted, with the EIMAC SK-1920 thermal link, in the approximate center of the copper surface, with thermal joint compound again used between the tube anode and the BeO link, and between the BeO link and the copper. A device such as the modified DE-STA-CO toggle clamp is used to hold the tube securely in place.

Socketing is accomplished with one of the units mentioned earlier, mounted so as to allow for free air convection around the base of the tube and the socket, and on a bracket which returns to the same heat sink if possible. The designer is cautioned to allow for some lateral movement in the socket mount, and to make sure the anode is flat against the BeO thermal link so that good conduction contact exists before the socket mounts are tightened down. If the tube anode, the thermal link, and the heat sink are not making good flat contact, heat transfer will be seriously affected.

If unusually high ambient temperatures are expected, or more than 200 watts capability is required, a small fan can be used to move air past the sink cooling fins. With any conduction-cooled power tube, dissipation capability is almost completely dependent on the ability of the heat-sink system to carry heat away and the temperature limitations of the tube itself. Thus the 200-watt dissipation rating of the 8873 is a nominal value only, as illustrated by the fact that the same tube, with an axial-flow air radiator installed (the 8874) is rated for 400 watts of dissipation under specified cooling conditions.

In all cases, temperature of the tube anode and the ceramic/metal seals is the limiting factor, and the equipment designer is encouraged to use temperature-sensitive paint or other temperature-sensing devices in connection with any equipment design before the layout is finalized.

8874 - Forced-air cooling must be provided to maintain the anode core and seal temperatures within maximum rating. The cooling data shown is for sea level, with cooling air at 50°C, and is sufficient to limit tube temperatures to 225°C. The pressure drop figures shown are for the anode cooler only, as would be the case with a pressurized anode compartment of an equipment, where air would be required to pass through the anode cooler and then through an insulated duct to the outside of the cabinet. Some air from the pressurized anode compartment can be bled by the socket for base cooling, either by means of a somewhat oversize socket-mounting hole, or a series of small holes drilled in the chassis near the edges of the socket, in order to provide a small amount of air circulation around the base pins of the tube.

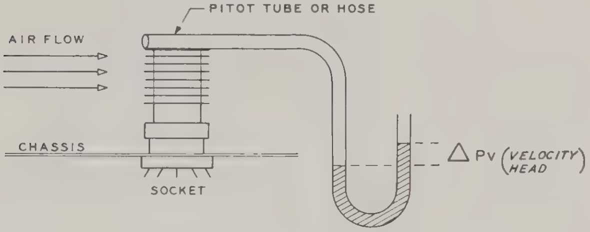
8874

Anode Diss.	Air Flow (CFM)	Approx. Press. Drop (In.H_2O)
200 W	4.0	0.11
300 W	6.0	0.22
400 W	8.6	0.37

8875 - Forced-air cooling must be provided to maintain the anode core and seal temperatures within the maximum rating. Cooling data is shown for sea level, with cooling air at 25°C.

These figures are for the case where the cooling air is supplied from a small general-purpose fan in close proximity to the tube and directing air across the tube and through the anode cooler.

The recommended cooling is sufficient to limit tube temperatures to 225°C. The required air velocity can be checked with a simple manometer, as shown in the accompanying figure.



8875

Anode Diss.	Cooling Air Velocity	Vel.Head(ΔPv) Inches of H_2O
200W	870 Ft/Min.	0.045
300W	1600 Ft/Min.	0.16

With all three tube types, the equipment designer is cautioned that it is not good practice to operate at, or very close to, the absolute maximum temperature ratings for the metal/ceramic seals. Where long life and consistent performance are factors, cooling in excess of the minimum requirements outlined here is normally beneficial.

DANGER-BERYLLIUM OXIDE CERAMICS (BeO) Do not alter, grind, lap, fire, chemically clean,or perform any other operation on the SK-1920 Beryllium Oxide thermal link used with the 8873, or any other equivalent section of BeO used with the 8873. Normal use of Beryllium Oxide ceramics parts is not hazardous, but the user is cautioned that breathing small quantities of the dust or fumes from Beryllium Oxide can seriously injure or kill.

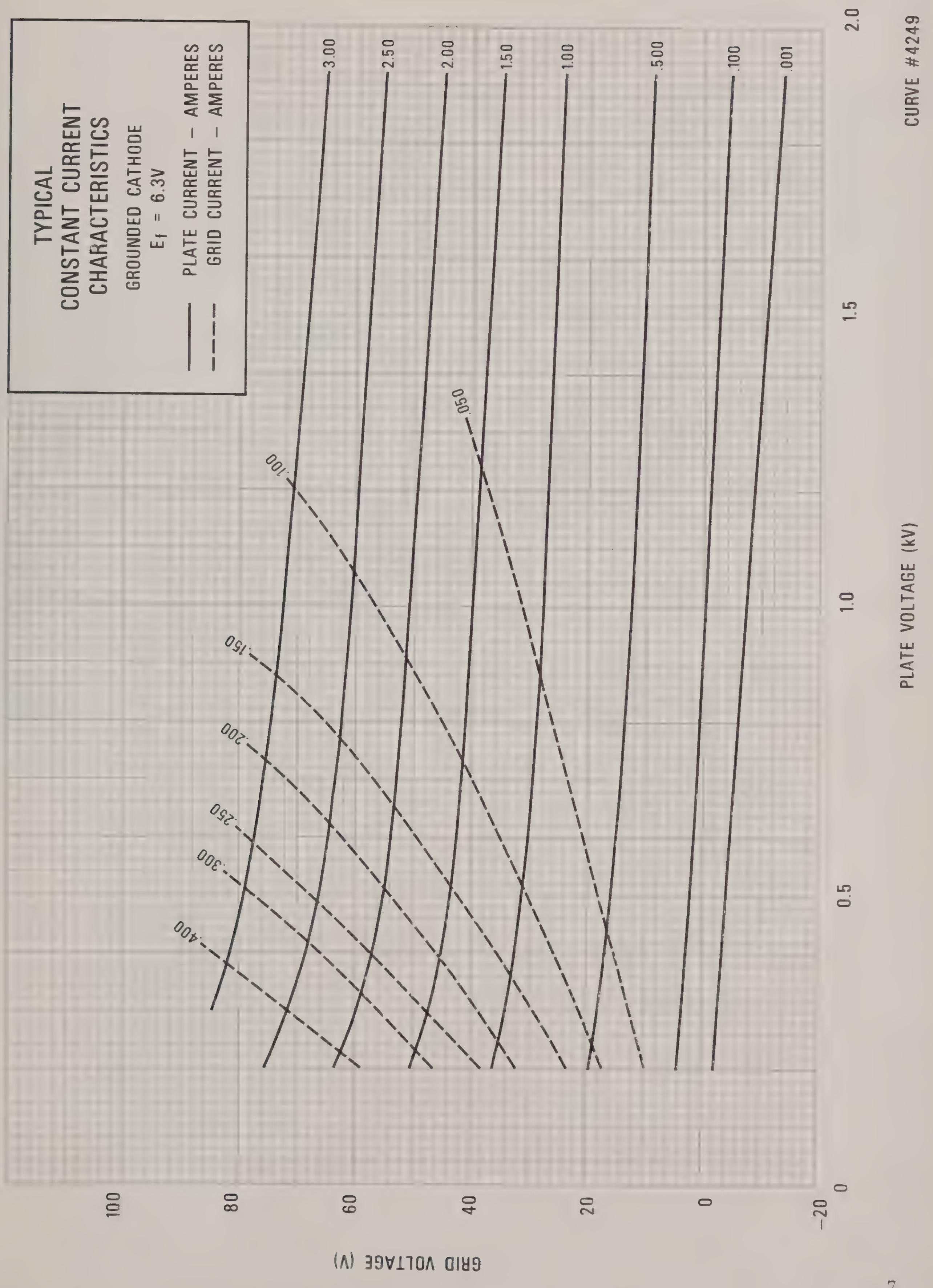
HIGH VOLTAGE - The 8873, 8874, and 8875 operate at voltages which can be deadly, and the equipment must be designed properly and operating precautions must be followed. Equipment must be designed so that no one can come in contact with high voltages. All equipment must include safety enclosures for high-voltage circuits and terminals, with interlock switches to open the primary circuits of the power supplies and to discharge high voltage condensers whenever access doors are opened. Interlock switches must not be bypassed or "cheated" to allow operation with access doors open. Always remember that HIGH VOLTAGE CAN KILL.

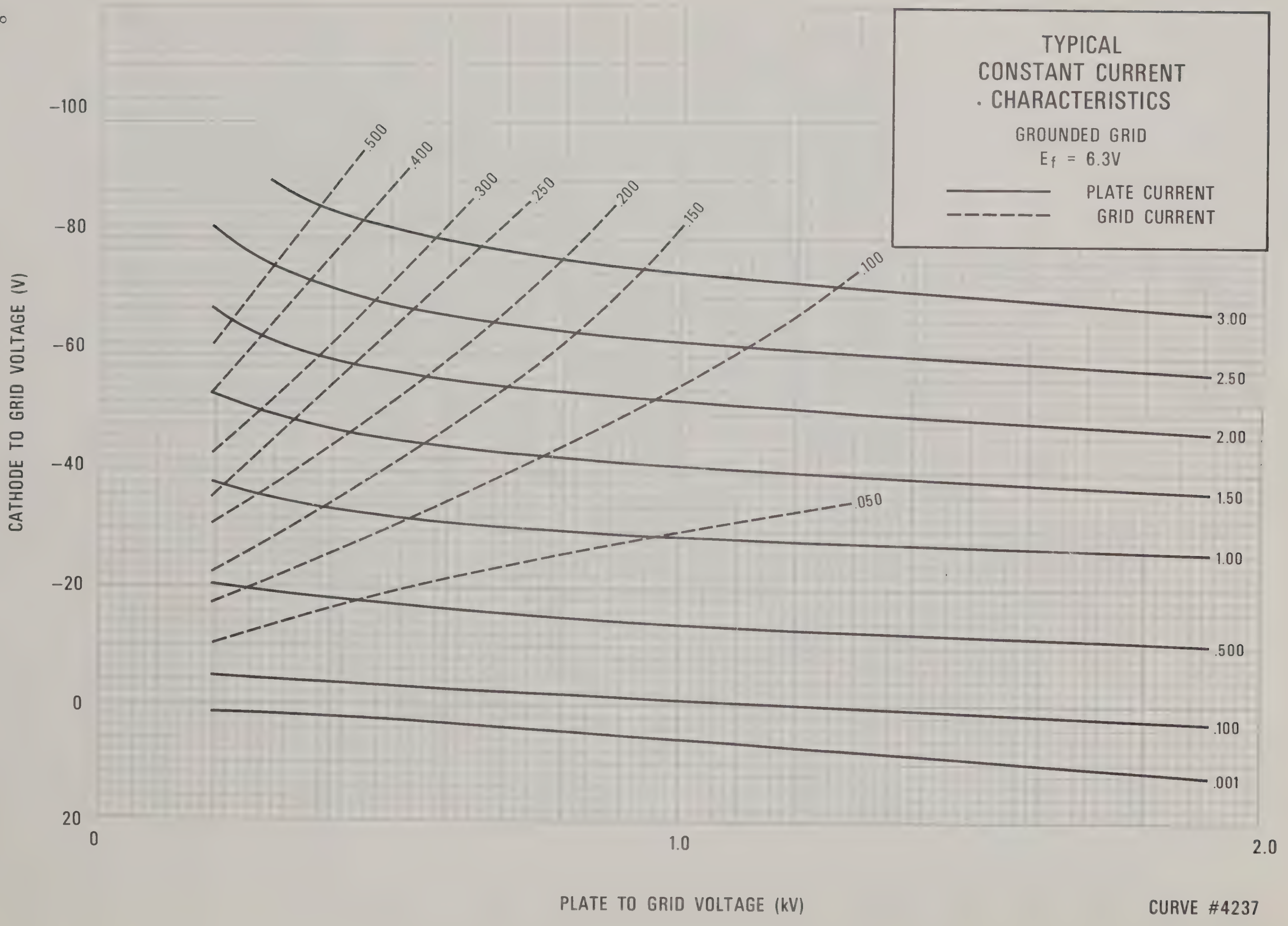
OUTPUT CAPACITANCE - The interelectrode capacitance figures given in the General Characteristics are measured in a shielded fixture and do not include additional external capacitance. Including the stray capacitance between the anode and the heat sink used with the 8873 tube will typically raise the output capacitance to somewhat more than double the measured internal value.

INTERMODULATION DISTORTION - Typical Operating Conditions, with distortion values included, are the result of data taken during actual operation at 2 Megahertz. Intermodulation values listed are those measured at the full peak envelope power noted and are referenced against one tone of a two-equal tone signal.

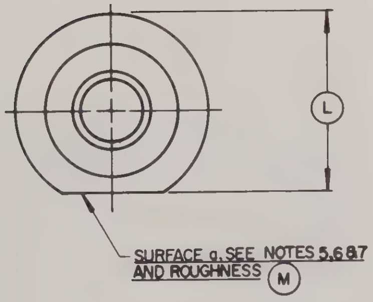
INPUT CIRCUIT - When any of these types is operated as a grounded-grid rf amplifier, the use of a resonant tank in the cathode circuit is recommended in order to obtain greatest linearity and power output. For best results with a single-ended amplifier it is suggested that the cathode tank circuit operate at a "Q" of two or more.

SPECIAL APPLICATIONS - If it is desired to operate this tube under conditions widely different from those given here, write to Power Grid Tube Division, EIMAC, Division of Varian, 301 Industrial Way, San Carlos, California 94070 for information and recommendations.


TYPICAL CONSTANT CURRENT CHARACTERISTICS
GROUNDED CATHODE
E_f = 6.3V
PLATE CURRENT – AMPERES
GRID CURRENT – AMPERES
3.00
2.50
2.00
1.50
1.00
.500
.100
.001
.050
.100
.150
.200
.250
.300
.400
GRID VOLTAGE (V)
100
80
60
40
20
0
−20
PLATE VOLTAGE (kV)
0
0.5
1.0
1.5
2.0
CURVE #4249


TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
GROUNDED GRID
E_f = 6.3V
PLATE CURRENT
GRID CURRENT
CATHODE TO GRID VOLTAGE (V)
-100
-80
-60
-40
-20
0
20
0
1.0
2.0
PLATE TO GRID VOLTAGE (kV)
.500
.400
.300
.250
.200
.150
.100
.050
3.00
2.50
2.00
1.50
1.00
.500
.100
.001

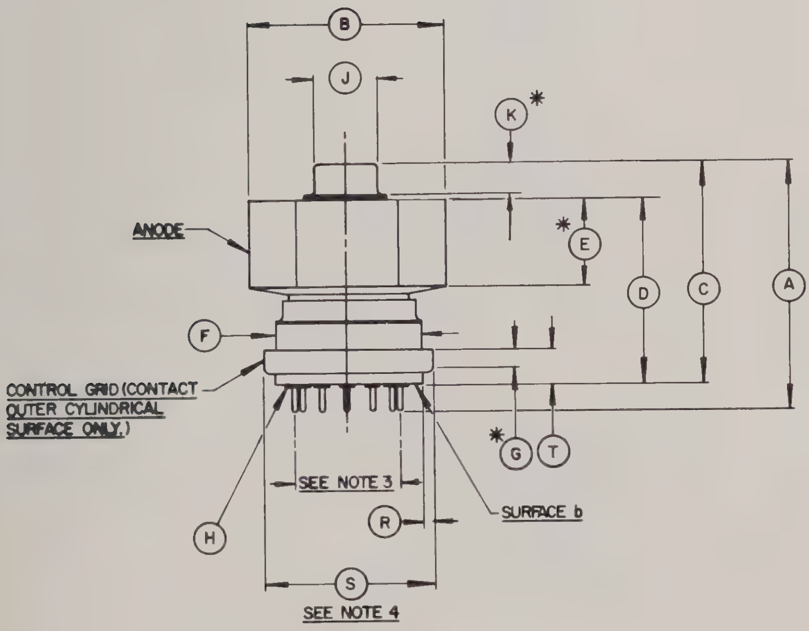
CURVE #4237



PIN NO. 1	CATHODE
PIN NO. 2	CATHODE
PIN NO. 3	CATHODE
PIN NO. 4	CONTROL GRID
PIN NO. 5	HEATER
PIN NO. 6	HEATER
PIN NO. 7	CONTROL GRID
PIN NO. 8	CATHODE
PIN NO. 9	CATHODE
PIN NO. 10	CATHODE
PIN NO. 11	CONTROL GRID

DIMENSIONAL DATA

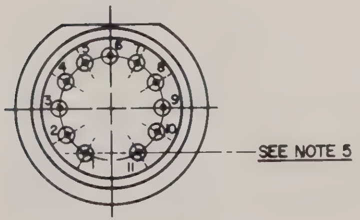
DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	- -	2.260	- -	- -	57.40	- -
B	1.160	1.640	- -	40.89	41.66	- -
C	1.855	1.985	- -	47.12	50.42	- -
D	1.595	1.625	- -	40.51	41.28	- -
E	0.710	0.790	- -	18.03	20.07	- -
F	- -	1.250	- -	- -	31.75	- -
G	0.150	- -	- -	3.81	- -	- -
H	BASE E11-81 (JEDEC)				BASE E11-81 (JEDEC)	
J	0.559	0.573	- -	14.20	14.55	- -
K	0.240	- -	- -	6.10	- -	- -
L	1.525	1.540	- -	38.74	39.12	- -
M(✱)	- -	32AA	- -	- -	- -	- -
N	89°	91°	- -	89°	91°	- -
R	0.080	- -	- -	2.03	- -	- -
S	1.416	1.436	- -	35.97	36.47	- -
T	0.280	0.320		7.11	8.13	- -



NOTES:

1. REF. DIMENSIONS ARE FOR INFO. ONLY & ARE NOT REQUIRED FOR INSPECTION PURPOSES.
2. (✱) CONTACT SURFACE.
3. PIN PITCH DIA. TO BE CONCENTRIC TO B WITHIN .040 DIA.
4. DIM. S TO BE CONCENTRIC TO B & PIN PITCH DIA. WITHIN .030 DIA.
5. SURFACE a TO BE PARALLEL TO PINS 1 & 11 AXIS WITHIN 2° & ON OPOSITE SIDE.
6. SURFACE a MUST BE FLAT WITHIN .001 & PERP. TO SURFACE b WITHIN Ⓝ LIMITS.
7. SURFACE a TO BE FREE OF ANY CODING OR LABELING.

✱ SURFACE ROUGHNESS (ASA B46.1-62)

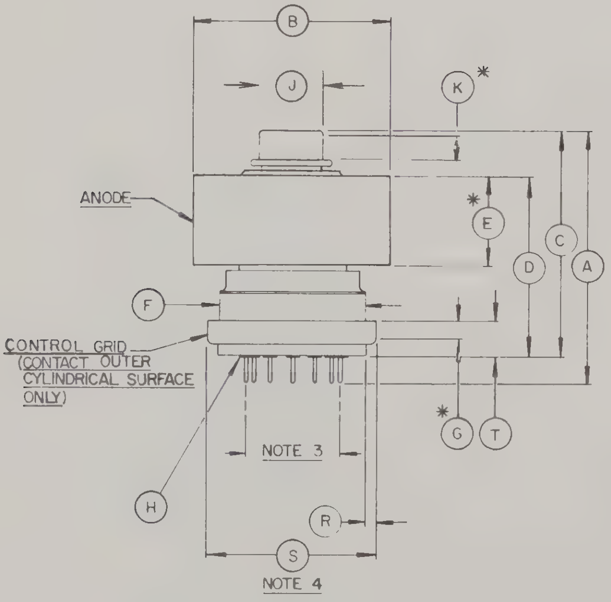


8873

PIN NO. 1	CATHODE
PIN NO. 2	CATHODE
PIN NO 3	CATHODE
PIN NO.4	CONTROL GRID
PIN NO.5	HEATER
PIN NO.6	HEATER
PIN NO.7	CONTROL GRID
PIN NO.8	CATHODE
PIN NO 9	CATHODE
PIN NO.10	CATHODE
PIN NO.11	CONTROL GRID

DIMENSIONAL DATA

DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	- -	2.260	- -	- -	57.40	- -
B	1.610	1.640	- -	40.89	41.66	- -
C	1.855	1.985	- -	47.12	50.42	- -
D	1.470	1.600	- -	37.34	40.64	- -
E	0.710	0.790	- -	18.03	20.07	- -
F	- -	1.250	- -	- -	- -	- -
G	0.150	- -	- -	31.75	- -	- -
H	BASE E11-81 (JEDEC)			BASE E11-81 (JEDEC)		
J	0.559	0.573	- -	14.20	14.55	- -
K	0.240	- -	- -	6.10	- -	- -
R	0.080	- -	- -	2.03	- -	- -
S	1.416	1.436	- -	35.97	36.47	- -
T	0.280	0.320	- -	7.11	8.13	- -



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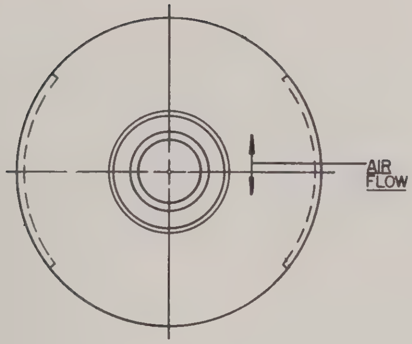
2. (*)CONTACT SURFACE.
3. PIN PITCH DIA. TO BE CONCENTRIC TO B WITHIN .040 DIA.
4. DIM. S TO BE CONCENTRIC TO B & PIN PITCH DIA. WITHIN .030 DIA.

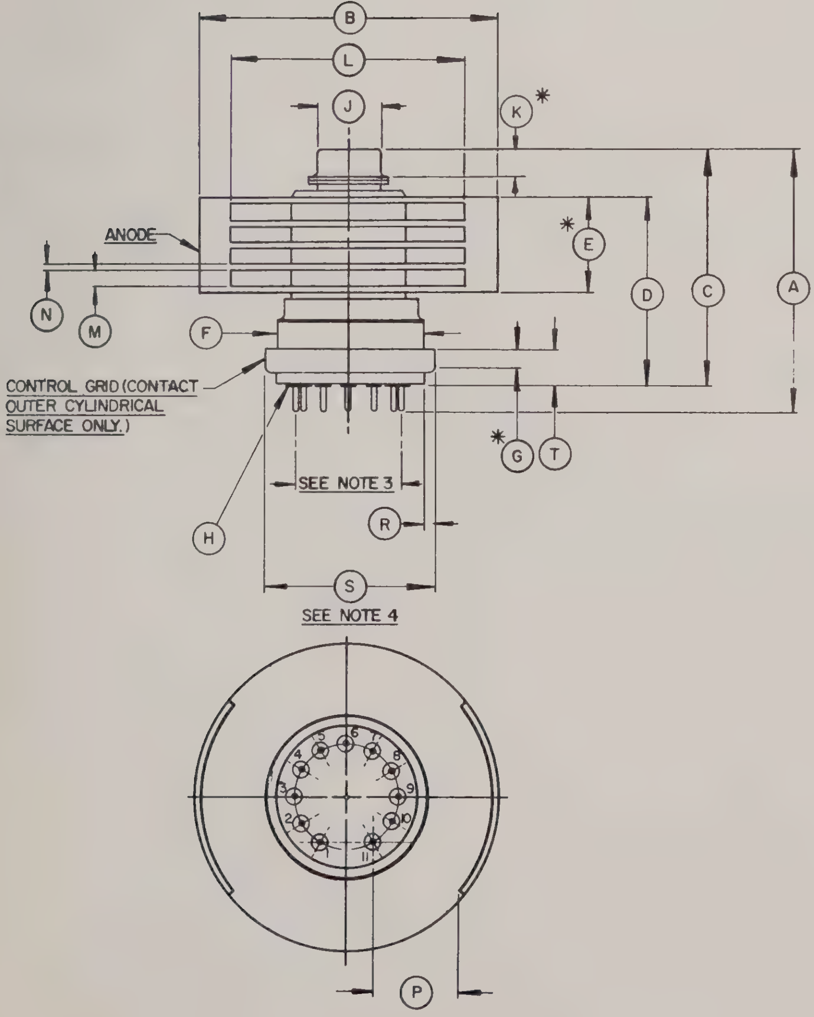
8874



PIN NO. 1	CATHODE
PIN NO. 2	CATHODE
PIN NO. 3	CATHODE
PIN NO. 4	CONTROL GRID
PIN NO. 5	HEATER
PIN NO. 6	HEATER
PIN NO. 7	CONTROL GRID
PIN NO. 8	CATHODE
PIN NO. 9	CATHODE
PIN NO. 10	CATHODE
PIN NO. 11	CONTROL GRID

DIMENSIONAL DATA

DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	- -	2.260	- -	- -	57.40	- -
B	2.480	2.520	- -	62.99	64.01	- -
C	1.855	1.985	- -	47.12	50.42	- -
D	1.470	1.600	- -	37.34	40.64	- -
E	0.750	0.830	- -	19.05	21.08	- -
F	- -	1.250	- -	- -	31.75	- -
G	0.150	- -	- -	3.81	- -	- -
H	BASE E11-81 (JEDEC)			BASE E11-81 (JEDEC)		
J	0.559	0.573	- -	14.20	14.55	- -
K	0.240	- -	- -	6.10	- -	- -
L	- -	- -	1.440	- -	- -	36.58
M	- -	- -	0.135	- -	- -	3.43
N	- -	- -	0.050	- -	- -	1.27
P	- -	- -	0.560	- -	- -	4.22
R	0.080	- -	- -	2.03	- -	- -
S	1.416	1.436	- -	35.97	36.47	- -
T	0.280	0.320	- -	7.11	8.13	- -



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4. DIM. S TO BE CONCENTRIC TO B & PIN PITCH DIA. WITHIN .030 DIA.

8875

Eimac®

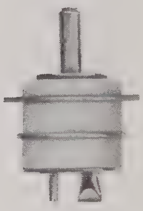
EIMAC
Division of Varian
SAN CARLOS
CALIFORNIA

PRELIMINARY DATA

8892

PLANAR TRIODE

The 8892 is a compact, rugged ceramic/metal planar triode intended for CW use or as a plate- or grid-pulsed oscillator or amplifier. It features high power output, high plate efficiency and excellent frequency stability under severe environmental conditions. The construction of the 8892 readily lends itself to cavity circuit operation resulting in an extremely compact rf source. The 8892 is capable of providing in excess of 1 kW peak power at 6 GHz.



GENERAL CHARACTERISTICS[1]

ELECTRICAL

Cathode: Oxide Coated, Unipotential	
Heater: Voltage	6.3 (±5%) V
Current, at 6.3 volts	0.65 A
Cathode Heating Time	60 sec.
Transconductance (Average)	30 mmhos
Amplification Factor (Average)	60
Direct Interelectrode Capacitance, without heater voltage	
Grid-Cathode	5.00 pF
Grid-Plate	1.60 pF
Plate-Cathode (maximum)	0.06 pF
Plate Dissipation (maximum)[2]	50 W
Grid Dissipation (maximum)	1.5 W

1. The data presents the nominal design objectives for this product and the characteristics and specifications of this type are subject to change. The device is now under development and is made available for experimental purposes only. For the most recent information concerning the status of this development, please contact your nearest Varian Electron Tube and Device Field Office or the Product Manager, Eimac Division of Varian, Salt Lake City, Utah.

2. With forced air cooling or appropriate conduction and/or convection cooling.

MECHANICAL

Maximum Overall Dimensions:	
Length	1.059 in; 26.90 mm
Diameter	0.758 in; 19.3 mm
Net Weight	0.25 oz; 7.0 gm
Operating Position	Any
Maximum Operating Temperature:	
Ceramic/Metal Seals	250°C
Cooling	Conduction and Forced Air

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RF OSCILLATOR
Class C, Pulsed

ABSOLUTE MAXIMUM RATINGS:

DC PLATE VOLTAGE	2.0	kVdc
PEAK PLATE VOLTAGE	2.5	kv
DC PLATE CURRENT	100	mAdc
DC GRID CURRENT	30	mAdc
PEAK PLATE CURRENT	3.0	a
PEAK GRID CURRENT	1.2	a
DC GRID VOLTAGE	-100	Vdc
PULSE DURATION[1]	3.0	µs
DUTY FACTOR[1]	.0025	
PEAK HEATER-CATHODE VOLTAGE[2]	±50	V
FREQUENCY	6.0	GHz

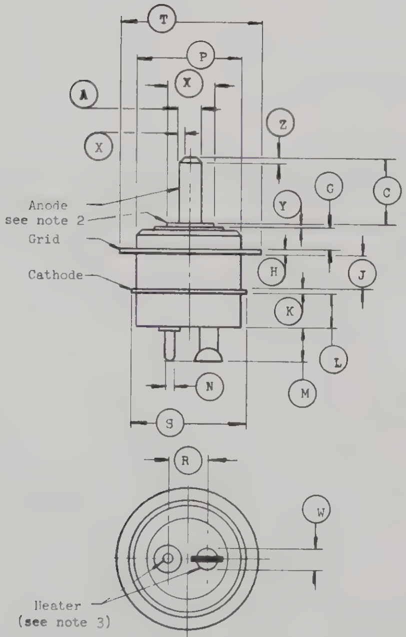
1. For applications requiring longer pulse duration and/or higher duty factor, please consult the Product Manager, EIMAC-Division of Varian, Salt Lake City, Utah.
2. The heater is electrically isolated from the cathode.

APPLICATION

The cathode and grid flanges should not be altered in any way such as by machining or filing, since final seal could be damaged. Maximum torque applied to flanges during installation should not exceed 15 inch pounds.

For optimum rf performance, the anode line should make good rf contact on the anode area indicated in the outline drawing.

Soldered connections may be made to the anode stud, grid or cathode flanges, and heater contacts where adequate heat sinking and good soldering practices are followed to minimize the heat applied to the tube and the thermal gradient across the metal to ceramic brazed areas.



DIMENSIONAL DATA

DIM	INCHES			MILLIMETERS		
	MIN	MAX	REF	MIN	MAX	REF
A	0.122	0.128	--	3.10	3.25	--
C	0.325	0.335	--	8.26	8.51	--
G	0.120	0.130	--	3.05	3.30	--
H	0.025	0.031	--	0.64	0.79	--
J	0.167	0.177		4.24	4.50	
K	0.025	0.031	--	0.64	0.79	--
L	0.170	0.185	--	4.32	4.70	--
M	0.170	0.190	--	4.32	4.83	--
N	0.047	0.053	--	1.19	1.35	--
P	0.535	0.565	--	13.59	14.35	--
R	0.185	0.215	--	4.70	5.46	--
S	0.598	0.608	--	15.19	15.44	--
T	0.748	0.758	--	19.00	19.25	--
W	--	--	0.100	--	--	2.54
X	0.250	0.260	--	6.35	6.60	--
Y	--	0.020	--	--	0.51	--

Note:
1. Ref. Dims. are for info. only & are not req'd. for inspection purposes.
2. For optimum rf performance the Anode line should make rf contact at this point on the Anode Cup.
3. Heater is electrically isolated from cathode.

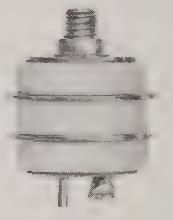
E I M A C
Division of Varian
SAN CARLOS
CALIFORNIA

PRELIMINARY DATA

8893

PLANAR TRIODE

The 8893 is a compact, rugged ceramic/metal planar triode intended for CW use or as a plate- or grid-pulsed oscillator or amplifier. It features high power output, high plate efficiency and excellent frequency stability under severe environmental conditions. The construction of the 8893 readily lends itself to cavity circuit operation resulting in an extremely compact rf source.



GENERAL CHARACTERISTICS[1]

ELECTRICAL

Cathode: Oxide Coated, Unipotential

Heater: Voltage	6.3 (±5%)	V
Current, at 6.3 volts	1.3	A
Cathode Heating Time	60	sec.
Transconductance (Average)	30	mmhos
Amplification Factor (Average)	60	

Direct Interelectrode Capacitance, without heater voltage

Grid-Cathode	8.00	pF
Grid-Plate	2.35	pF
Plate-Cathode (maximum)	0.10	pF
Plate Dissipation (maximum)[2]	100	W
Grid Dissipation (maximum)	1.5	W

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[1] The data presents the design objectives for this product and the characteristics and specifications of this type are subject to change. The device is now under development and is made available for experimental purposes only. For the most recent information concerning the status of this development, please contact your nearest Varian Electron Tube and Device Field Office or the Product Manager, Eimac Division of Varian, Salt Lake City, Utah.

[2] With forced air cooling or appropriate conduction and/or convection cooling.

MECHANICAL

Maximum Overall Dimensions:

Length	1.074 in; 2.73 mm
Diameter	0.758 in; 1.93 mm
Net Weight	0.35 oz; 10.0 gm
Operating Position	Any

Maximum Operating Temperature:

Ceramic/Metal Seals	250°C
Cooling	Forced Air

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RF OSCILLATOR
Class C, Pulsed

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE	2.0 kVdc
PEAK PLATE VOLTAGE	3.5 kv
DC PLATE CURRENT	150 mAdc
DC GRID CURRENT	45 mAdc
PEAK PLATE CURRENT	5.0 a
PEAK GRID CURRENT	1.5 a
DC GRID VOLTAGE	-100 Vdc
PULSE DURATION[1]	6.0 μs
DUTY FACTOR[1]	.004
PEAK HEATER-CATHODE VOLTAGE[2]	±50 V
FREQUENCY	4.0 GHz

1. For applications requiring longer pulse duration and/or higher duty factor, please consult the Product Manager, EIMAC-Division of Varian, Salt Lake City, Utah.
2. The heater is electrically isolated from the cathode.

REPRESENTITIVE OPERATION (Grid-Pulsed Oscillator)

Frequency	2.5 GHz
Heater Voltage	6.3 V
Heater Current	1.3 A
Duty Factor	0.01 maximum
Pulse Width	30 microseconds maximum
Peak Plate Voltage	1.5 kv
Peak Plate Current	3a maximum
Power Output (useful)	1 kw, minimum

APPLICATION

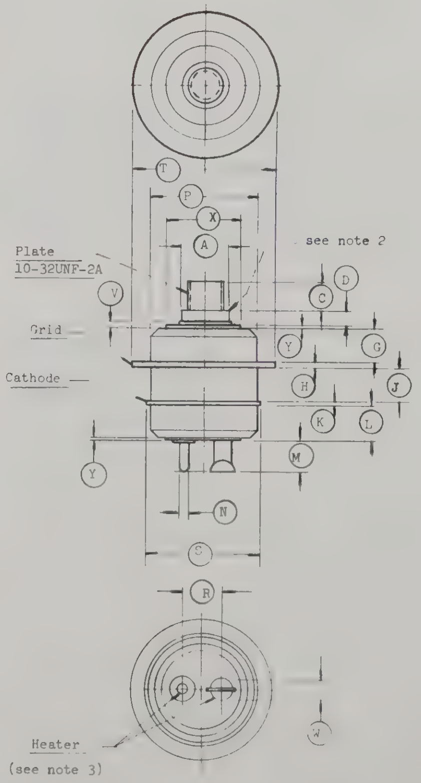
The cathode and grid flanges should not be altered in any way such as by machining or filing, since final seal could be damaged. Maximum torque applied to flanges during installation should not exceed 15 inch pounds.

For optimum rf performance, the anode line should make good rf contact on the anode area indicated in the outline drawing.

For further details on cooling or other aspects of tube operation, refer to the "Application Notes for Planar Triodes" bulletin which can be obtained on request.

DIMENSIONAL DATA

DIM	INCHES			MILLIMETERS		
	MIN	MAX	REF	MIN	MAX	REF
A	0.247	0.253	- -	6.27	6.43	- -
C	0.120	0.160	- -	3.05	4.06	- -
D	0.070	0.090	- -	1.78	2.29	- -
G	0.182	0.192	- -	4.62	4.88	- -
H	0.025	0.031	- -	0.64	0.79	- -
J	0.170	0.180	- -	4.32	4.57	- -
K	0.025	0.031	- -	0.64	0.79	- -
L	0.170	0.180	- -	4.32	4.57	- -
M	0.170	0.190	- -	4.32	4.83	- -
N	0.047	0.053	- -	1.19	1.35	- -
P	0.635	0.665	- -	16.13	16.89	- -
R	0.186	0.214	- -	4.72	5.44	- -
S	0.698	0.708	- -	17.73	17.98	- -
T	0.748	0.758	- -	19.00	19.25	- -
V	- -	0.040	- -	- -	1.02	- -
W	- -	- -	0.100	- -	- -	2.54
X	0.545	0.570	- -	13.84	14.48	- -
Y	- -	0.020	- -	- -	0.51	- -

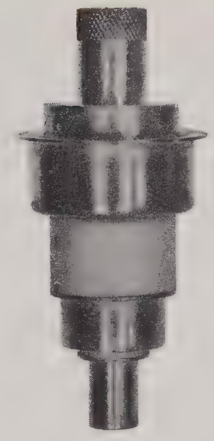


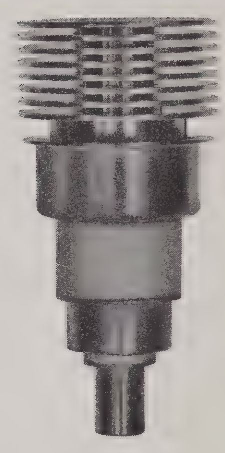
Notes: 1. Ref Dims. are for info. only and are not reqd for insp. purposes.
2. For optimum rf performance the Anode line should make rf contact at this point on the Anode Cup.
3. Heater is electrically isolated from cathode.

TECHNICAL DATA

8906
8907

PLANAR TRIODES


8906


8907

The EIMAC 8906 (formerly Y-572) and 8907 (formerly Y-581) are rugged ceramic/metal planar triodes designed for use as a CW, grid- or plate-pulsed oscillator or frequency multiplier up to 3 GHz, as well as for pulse modulator or voltage regulator service. The 8906 is supplied with a knob intended for conduction-convection cooling and the 8907 is supplied with radiator (P/N 014224) for forced air cooling. Except for the plate dissipation ratings, the characteristics of both tube types are identical.

An outstanding feature of these tubes is the low heater power requirement for such high current capability. Either type can normally be used in place of the 7815, 7815R and 8745 at the same heater voltage where higher current capability and/or longer life is desired. Replacement of the above tube types with either the 8906 or 8907 is possible in most cases. The tubes can also replace the 7211/7698 (or 7698R) when a 25% lower heater power requirement is desired. In addition, the 8906 and 8907 have the preferred features of the 7815 and 7211 type family: high-Mu, high transconductance, great mechanical strength, low interelectrode capacitance, high current capability and increased grid-to-anode insulator length. The cathode is of the arc resistant extended interface type, well proven in airline type applications, assuring reliable, long-life operation under adverse conditions.

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Cathode: Oxide Coated, Unipotential		
Heater: Voltage	6.0 ± 0.3	V
Current, at 6.0 volts	1.00	A
Transconductance (Average):		
$I_b = 160$ mA (200 mA/cm^2)	38	mmhos
Amplification Factor (Average)	80	
Direct Interelectrode Capacitances (grounded cathode)[2]		
Grid-Cathode	8.00	pF
Grid-Plate	1.98	pF
Plate-Cathode	0.06	pF
Cut-off Bias[3]	-30	V max.

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MECHANICAL

Maximum Overall Dimensions:	
Length	2.701 in; 68.60 mm
Diameter (8906)	1.195 in; 30.35 mm
Diameter (8907)	1.264 in; 32.11 mm
Net Weight (8906)	1.8 oz; 48 gm
Net Weight (8907)	2.2 oz; 63 gm
Operating Position	Any
Maximum Operating Temperature:	
Ceramic/Metal Seals	250°C
Anode Core	250°C
Cooling:	
8906	Conduction and Convection
8907	Forced Air
Terminals	Coaxial, Special

ENVIRONMENTAL

Shock, 11 ms, non-operating	60 G
Vibration, operating, all axes, 55 to 500 Hz	10 G
Altitude, max (in a suitable designed circuit)	70,000 ft

1. Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.

2. Capacitance values for a cold tube as measured in a special shielded fixture. When the cathode is heated to the proper temperature, the grid-cathode capacitance will increase from the cold value by approximately 1 pF due to thermal expansion of the cathode.

3. Measured with one milliampere plate current and a plate voltage of 1 kVdc.

CW RF POWER AMPLIFIER OR OSCILLATOR

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE	2500	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
GRID NEGATIVE TO CATHODE	-400	VOLTS
GRID POSITIVE TO CATHODE	30	VOLTS
DC PLATE CURRENT	150	MILLIAMPERES
DC GRID CURRENT	45	MILLIAMPERES
PLATE DISSIPATION		
8906	10	WATTS
8907	100	WATTS
GRID DISSIPATION	1.5	WATTS
FREQUENCY	2.5	GIGAHERTZ

REPRESENTATIVE OPERATION

Grounded Grid CW r-f Power Amplifier

DC Plate Voltage	630	Vdc
DC Cathode Current	140	mAdc
DC Grid Voltage (Approx.)	-5	Vdc
DC Grid Current	25	mAdc
Drive Power (Approx.)	4	W
Useful CW Power Output	45	W
Heater Voltage	6.0	V
Frequency	700	MHz

Grounded Grid CW r-f Oscillator

DC Plate Voltage	1000	Vdc
DC Plate Current	140	mAdc
DC Grid Voltage (Approx.)	-20	Vdc
DC Grid Current (Approx.)	30	mAdc
Useful CW Power Output	30	W
Heater Voltage	5.0	V
Frequency	2.5	GHz

RF POWER AMPLIFIER OR OSCILLATOR

Grid- or Plate-Pulsed

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE (Grid-Pulsed)	3500	VOLTS
PEAK PULSE PLATE VOLTAGE (Plate-Pulsed)	4500	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
GRID NEGATIVE TO CATHODE	-700	VOLTS
GRID POSITIVE TO CATHODE	200	VOLTS
PULSE PLATE CURRENT	5.0	AMPERES
PULSE GRID CURRENT	2.5	AMPERES
PLATE DISSIPATION		
8906	10	WATTS
8907	100	WATTS
GRID DISSIPATION	1.5	WATTS
FREQUENCY	3.0	GIGAHERTZ
PULSE DURATION [1]	6	μs
DUTY FACTOR [1]	0033	

REPRESENTATIVE OPERATION

Grid-Pulsed r-f Amplifier

DC Plate Voltage	2200	Vdc
Peak Video Plate Current	2.5	a
DC Grid Voltage	-50	Vdc
Peak Video Grid Current	1.0	a
Pulse Drive Power	400	w
Useful Power Output (Approx.)	2500	w
Duty Factor	.002	
Pulse Width	3	μs
Heater Voltage	6.0	V
Frequency	1.1	GHz

Plate-Pulsed r-f Oscillator

Peak Plate Voltage	3500	v
Peak Video Plate Current	4.8	a
Peak Video Grid Current	1.5	a
Useful Power Output	3000	w
Duty Factor	.0025	
Pulse Width	3	μs
Heater Voltage	5.8	V
Frequency	3.0	GHz

PULSE MODULATOR OR PULSE AMPLIFIER SERVICE

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE	3500	VOLTS
PEAK PLATE VOLTAGE	4500	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
GRID NEGATIVE TO CATHODE	-750	VOLTS
GRID POSITIVE TO CATHODE	150	VOLTS
PULSE CATHODE CURRENT	7.5	AMPERES
DC PLATE CURRENT	150	MILLIAMPERES
PLATE DISSIPATION		
8906	10	WATTS
8907	100	WATTS
GRID DISSIPATION	1.5	WATTS
PULSE DURATION	6	μs
DUTY FACTOR [1]	0033	
CUT-OFF MU [1]	60	

[1] For application requiring longer pulse duration and/or higher duty cycle consult the nearest Varian Electron Tube and Devices Field Office, or the Product Manager, EIMAC Division of Varian, Salt Lake City, Utah.

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.	
Heater: Current at 6.0 volts	0.90	1.05	A
Cathode Heating Time	60	---	sec
Interelectrode Capacitances [1] (grounded cathode connection)			
Grid-Cathode	7.0	9.0	pF
Plate-Cathode	---	0.06	pF
Grid-Plate	1.86	2.10	pF

[1] Capacitance values for a cold tube as measured in a special shielded fixture. When the cathode is heated to the proper temperature, the grid-cathode capacitance will increase from the cold value by approximately 1 pF due to thermal expansion of the cathode.

APPLICATION

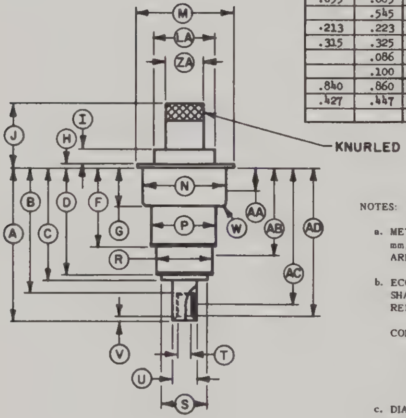
For general application information please refer to the bulletin "Operating Instructions for Planar Triodes". The operating instructions should be consulted prior to the designing of new requirements around the above tube types. Higher plate dissipation of up to 150 watts is possible with the 8906 and 8907 tube type when using radiator P/N 158555. If this is required the tube order should call for the tube type Y-602. For unusual and special application consult the nearest Varian Electron Tube and Device Field Office, or the Product Manager, EIMAC Division of Varian, Salt Lake City, Utah.

ELECTRODE CONTACT AREA

DIM	MIN.	MAX.	MIN.	MAX.
AA	.035	.361	.89	9.17
AB	1.185	1.265	30.10	32.14
AC	1.534	1.728	38.96	43.89
AD	1.475	1.815	37.47	46.10
	DIM. IN INCHES		DIM. IN MILLIMETERS	

DIMENSION DATA

DIM. IN INCHES			DIM. IN MILLIMETERS		
MIN.	MAX.	DIM	MIN.	MAX.	NOTES
1.185	1.875	A	46.10	47.62	
	1.534	B		38.96	
	1.475	C		37.46	
1.289	1.329	D	32.74	33.76	
.970	1.010	F	24.64	25.65	
.462	.477	G	11.73	12.12	
	.040	H		1.02	
	.185	I		4.70	
.766	.826	J	19.46	20.98	
1.180	1.195	M	29.97	30.35	
1.025	1.035	N	26.04	26.29	c
.752	.792	P	19.10	20.12	d
.655	.665	R	16.64	16.89	c
	.545	S		13.84	
.213	.223	T	5.41	5.66	c
.315	.325	U	8.00	8.26	c
	.086	V		2.18	
	.100	W		2.54	
.840	.860	LA	21.34	21.84	
.427	.447	ZA	10.75	11.35	



NOTES:

a. METRIC EQUIVALENTS, TO THE NEAREST .01 mm, ARE FOR GENERAL INFORMATION ONLY & ARE BASED UPON 1 inch = 25.4 mm.

b. ECCENTRICITY OF CONTACT SURFACES SHALL BE GAGED FROM CENTER LINE OR REFERENCE & SHALL BE AS FOLLOWS:

CONTACT SURFACE	TIR(MAX)	REFERENCE
ANODE	.020	CATHODE
GRID	.020	CATHODE
HEATER	.012	CATHODE

c. DIA'S N, R, T, & U SHALL APPLY THROUGHOUT ENTIRE LENGTH AS DEFINED BY DIM'S AA, AB, AC & AD RESPECTIVELY.

d. THIS SURFACE SHALL NOT BE USED FOR CLAMPING OR LOCATING.

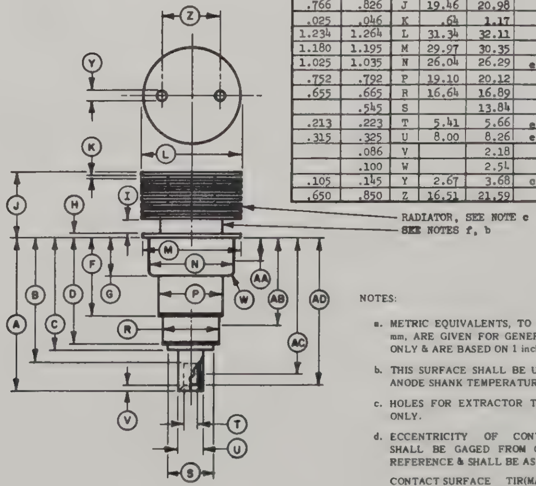
8906

ELECTRODE CONTACT DIMENSION

DIM	MIN.	MAX.	MIN.	MAX.
AA	.035	.361	.89	9.17
AB	1.185	1.265	30.10	32.14
AC	1.534	1.728	38.96	43.89
AD	1.475	1.815	37.47	46.10
	DIM. IN INCHES		DIM. IN MILLIMETERS	

DIMENSION DATA

DIM. IN INCHES			DIM. IN MILLIMETERS		
MIN.	MAX.	DIM	MIN.	MAX.	NOTES
1.185	1.875	A	46.10	47.62	
	1.534	B		38.96	
	1.475	C		37.46	
1.289	1.329	D	32.74	33.76	
.970	1.010	F	24.64	25.65	
.462	.477	G	11.73	12.12	
	.040	H		1.02	
.125	.185	I	3.18	4.70	
.766	.826	J	19.46	20.98	
.025	.046	K	.64	1.17	
1.234	1.264	L	31.34	32.11	
1.180	1.195	M	29.97	30.35	
1.025	1.035	N	26.04	26.29	e
.752	.792	P	19.10	20.12	
.655	.665	R	16.64	16.89	
	.545	S		13.84	
.213	.223	T	5.41	5.66	e
.315	.325	U	8.00	8.26	e
	.086	V		2.18	
	.100	W		2.54	
.105	.145	Y	2.67	3.68	c
.650	.850	Z	16.51	21.59	



NOTES:

a. METRIC EQUIVALENTS, TO THE NEAREST .01 mm, ARE GIVEN FOR GENERAL INFORMATION ONLY & ARE BASED ON 1 inch = 25.4 mm.

b. THIS SURFACE SHALL BE USED TO MEASURE ANODE SHANK TEMPERATURE.

c. HOLES FOR EXTRACTOR THROUGH TOP FIN ONLY.

d. ECCENTRICITY OF CONTACT SURFACES SHALL BE GAGED FROM CENTER LINE OF REFERENCE & SHALL BE AS FOLLOWS:

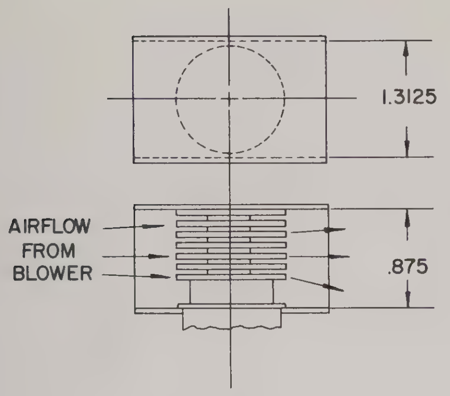
CONTACT SURFACE	TIR(MAX)	REFERENCE
ANODE	.020	CATHODE
GRID	.020	CATHODE
HEATER	.012	CATHODE

e. DIA'S N, R, T & U SHALL APPLY THROUGHOUT ENTIRE LENGTH AS DEFINED BY DIM'S AA, AB, AC & AD RESPECTIVELY.

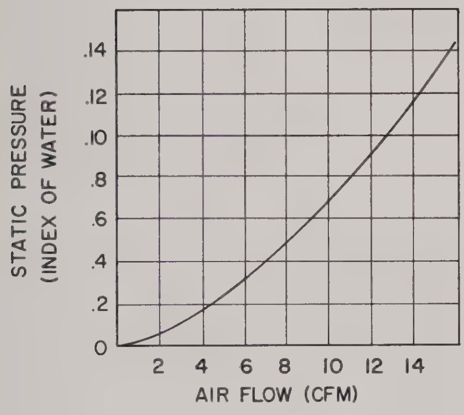
f. THIS SURFACE SHALL NOT BE USED FOR CLAMPING OR LOCATING.

8907

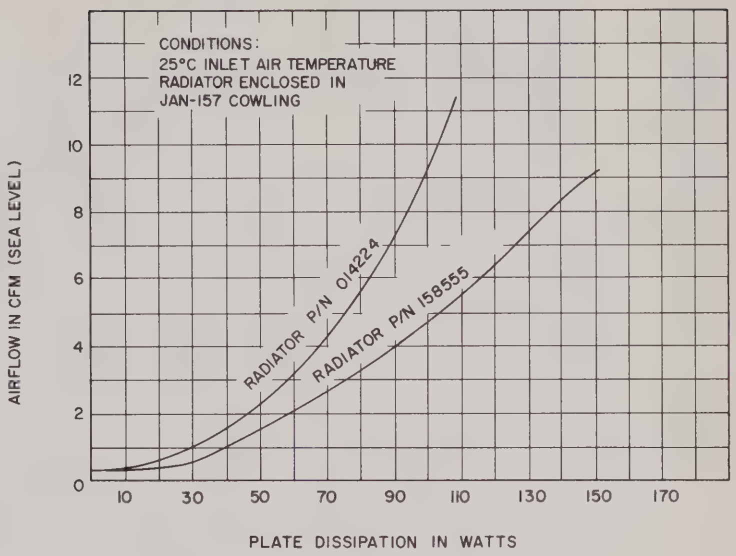
AIRFLOW vs STATIC PRESSURE WITH STANDARD COWLING JAN-157

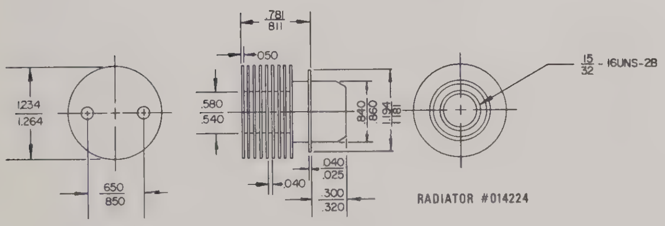


-STANDARD COWLING-



MAXIMUM PLATE DISSIPATION vs COOLING AIRFLOW

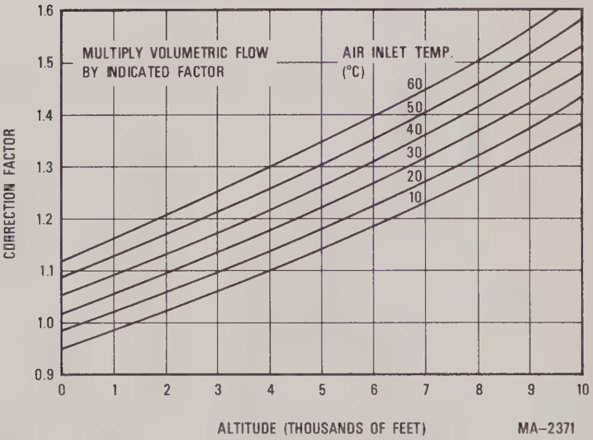




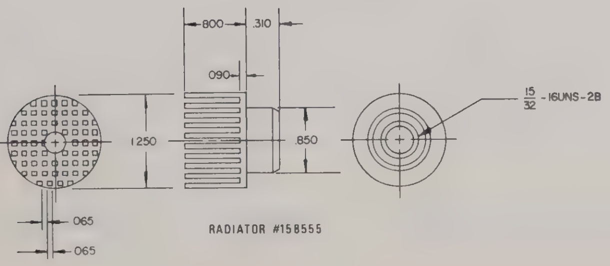
RADIATOR #014224

COMBINED CORRECTION FACTORS FOR INLET AIR TEMPERATURE AND ALTITUDE

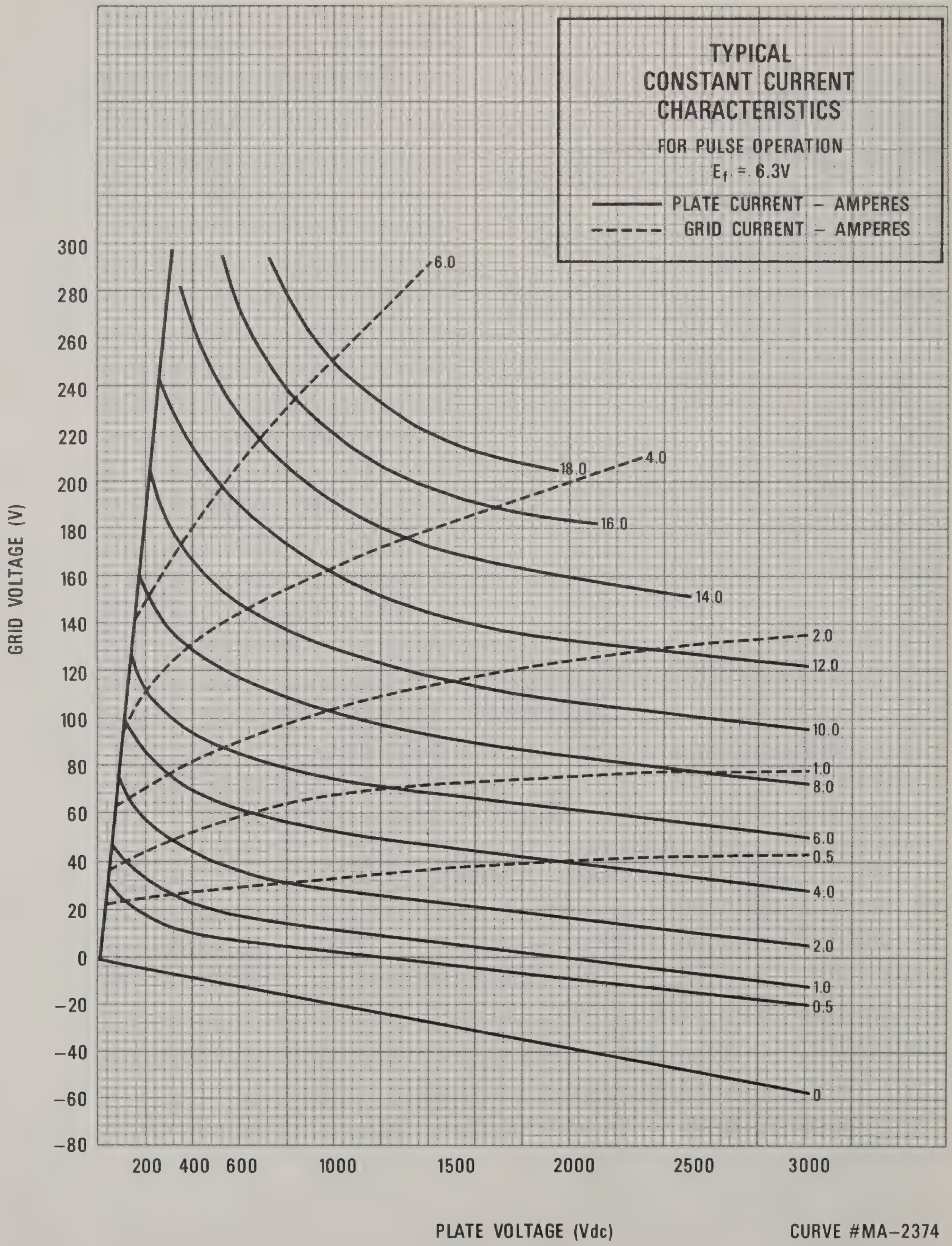
(RELATIVE TO 25°C AND SEA LEVEL)



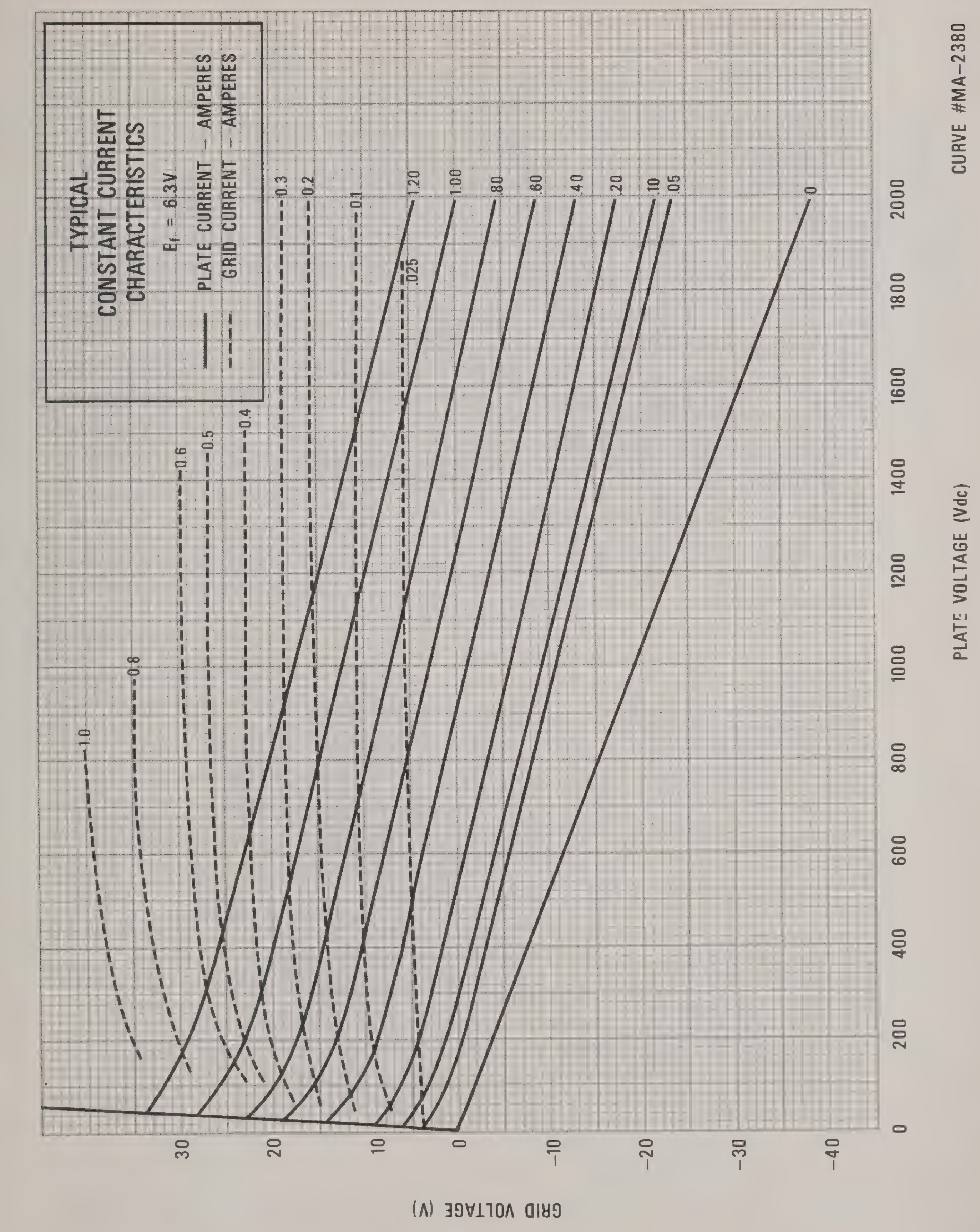
MA-2371



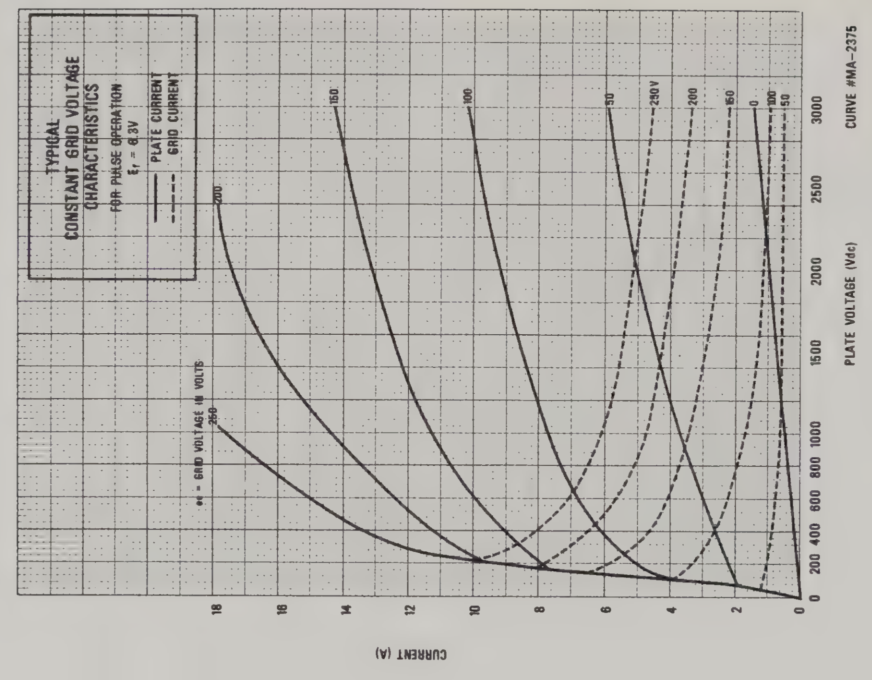
RADIATOR #158555

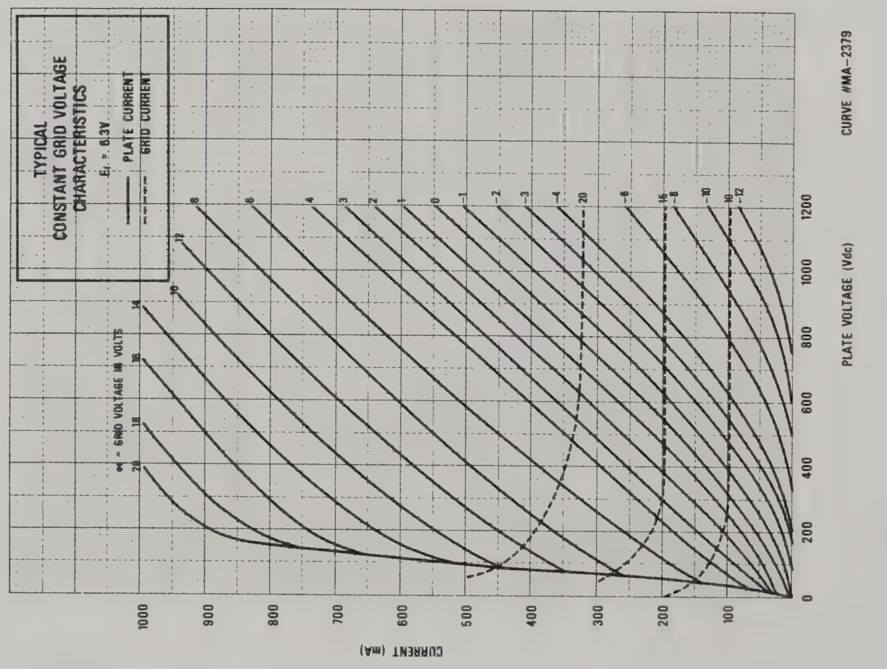


CURVE #MA–2374



CURVE #MA-2380


TYPICAL
CONSTANT GRID VOLTAGE
CHARACTERISTICS
FOR PULSE OPERATION
Ef = 6.3V
PLATE CURRENT
GRID CURRENT
ec = GRID VOLTAGE IN VOLTS
250
200
150
100
50
0
250 V
200
150
100
50
CURRENT (A)
0
2
4
6
8
10
12
14
16
18
0
200
400
600
800
1000
1500
2000
2500
3000
PLATE VOLTAGE (Vdc)
CURVE #MA-2375


TYPICAL
CONSTANT GRID VOLTAGE
CHARACTERISTICS
Ef = 6.3V
PLATE CURRENT
GRID CURRENT
ec = GRID VOLTAGE IN VOLTS
20
18
16
14
10
12
8
6
4
3
2
1
0
-1
-2
-3
-4
20
-6
16
-8
-10
10
-12
CURRENT (mA)
100
200
300
400
500
600
700
800
900
1000
0
200
400
600
800
1000
1200
PLATE VOLTAGE (Vdc)
CURVE #MA-2379

TECHNICAL DATA

8906AL
Y572AL

PLANAR TRIODE

The EIMAC 8906AL/Y572AL is a ceramic/metal planar triode specially processed and tested to assure high reliability in airborne service. Evaluation of this tube is based upon operating conditions in grid- or plate-pulsed oscillator service (transponder) and in grid- or plate-pulsed amplifier service in distance measuring equipment (DME). The testing emphasizes cathode emission capability at reduced heater voltage and high voltage hold-off, both features which are demanded in airline service.

The 8906AL/Y572AL is derived from the 7815AL/7211/7698 family. This new improved tube also contains the features of the original types, including rugged ceramic/metal construction, low interelectrode capacitance, high transconductance and high mu. The longer grid-anode ceramic insulator of the earlier type is used, making the 8906AL/Y572AL especially suited for high altitude airborne operation. The 8906AL/Y572AL has a 60% larger cathode area than the 7815/7815AL thus lowering cathode current loading per unit area yet maintaining as high or higher current capability.

In addition to these features, this tube also incorporates the arc-resistant cathode which assures stable operation under adverse conditions and which minimizes catastrophic failure due to arc-over during circuit malfunction. The tube is useable from dc to 3 GHz.

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Cathode: Oxide Coated, Unipotential		
Heater: Voltage	5.7 (±2%)	V
Current, at 5.7 volts	0.95	A
Transconductance (Average):		
I_b= 100 mAdc, E_b = 600 Vdc	30	mmhos
Amplification Factor (Average)	80	
Direct Interelectrode Capacitance (grounded cathode)[2], without heater voltage:		
Grid-Cathode	8.00	pF
Grid-Plate	1.98	pF
Plate-Cathode (maximum)	0.060	pF

---

1. Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.

2. Capacitance values are for a cold tube as measured in a special shielded fixture.

(Effective 9-1-70) © 1970 by Varian Printed in U.S.A.

MECHANICAL

Maximum Overall Dimensions:	
Length	2.701 in; 68.60 mm
Diameter	1.195 in; 30.35 mm
Net Weight	1.8 oz; 48 gm
Operating Position	Any
Maximum Operating Temperature:	
Ceramic/Metal Seals	250°C
Anode Core	250°C
Cooling	Conduction and Convection
Terminals	Special

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.	
Heater Current at 5.7 volts	0.87	1.02	A
Cut-off Bias[1]	---	-25	V
Grid-Plate Capacitance[2]	1.85	2.10	pF
Grid-Cathode Capacitance[2]	7.00	9.00	pF
Plate-Cathode Capacitance	---	0.060	pF

1. Measured with 1 mA plate current and a plate voltage of 1000 Vdc.
2. Capacitance values as measured with a cold tube and in a shielded socket. When the cathode is heated to the proper temperature the grid-cathode capacitance will increase by approximately 1 pF due to thermal expansion of the cathode support.

RF POWER AMPLIFIER OR OSCILLATOR

Grid- or Plate-Pulsed

MAXIMUM RATINGS, ABSOLUTE VALUES

DC PLATE VOLTAGE	3500	VOLTS
PEAK PULSE PLATE VOLTAGE		
PLATE PULSED	4500	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
Grid negative to cathode	750	VOLTS
Grid positive to cathode	250	VOLTS
PULSE PLATE CURRENT	5.0	AMPERE
PULSE GRID CURRENT	2.5	AMPERE
DC CATHODE CURRENT	200	MILLIAMPERES
AVERAGE PLATE DISSIPATION[1]		
Conduction and Convection	10	WATTS
GRID DISSIPATION (Average)	2	WATTS
DUTY FACTOR[2]	.0033	
PULSE DURATION[2]	6	μs
FREQUENCY	3	GHz

1. Higher plate dissipation is permissible when EIMAC radiator (P/N 014224) is used.
2. For longer pulse duration or higher duty cycle, consult the nearest Varian Electron Tube and Device Group Sales Office, or the Product Manager, EIMAC Division of Varian, Salt Lake City, Utah.

OPERATING CONDITIONS FOR THE 8906AL/Y572AL in REPRESENTATIVE APPLICATION.

Grid-Pulsed Oscillator

Frequency	1.090	GHz
Heater Voltage	5.7	V
DC Plate Voltage	2000	Vdc
DC Grid Voltage	-75	Vdc
Peak Plate Current	1.1	a
Peak Grid Current	0.8	a
Pulse Duration	0.5	μs
Duty	0.001	
Useful Power Output (Approx.)	850	w

Plate-Pulsed Amplifier

Frequency	1.1	GHz
Heater Voltage	5.7	V
Peak Plate Pulse Voltage	2000	v
DC Grid Voltage	-45	Vdc
Peak Plate Current	2.0	a
Peak Grid Current	1.0	a
Pulse Duration	3.5	μs
Duty	0.001	
Driving Power	300	w
Useful Power Output (Approx.)	2000	w
Gain	8	db
Plate Efficiency	50%	

APPLICATION

MECHANICAL

MOUNTING - The important dimensions of the tube are carefully controlled with respect to the reference surface as shown on the outline drawing. The reference surface is intended to serve as a tube stop and the location of the tube in the circuit should therefore be determined by this surface coming in positive contact with a precisely positioned member of the socket or cavity. Adherence to this practice will assure both mechanical and electrical interchangeability of all tubes of a given type. If a non-designated surface is used as a tube stop, faulty positioning of the tube in the cavity and possible imcomplete electrical contact can result in improper tuning, reduced power output and damage to the cavity, tube or both. Contact surfaces, with reference to the designated tube stop are shown in the outline drawing. Electrical contact to the cathode, grid, anode and also the heater should be restricted to these designated contact areas.

Dimensions should never be taken from sample tubes. Dimensional changes due to normal variations in undimensioned surfaces may occur within the limits specified on the outline drawing. Use of nondesignated electrical contact surfaces might therefore result in incomplete contact or mechanical interference, causing changes in cavity tuning.

Electrical contact should be made by spring finger collets bearing against the previously described contact areas. If connections are employed which do not provide multiple contacts to the designated contact areas, concentration of RF current will result in loss of output power, especially at higher frequencies. The spring contacts used should exert a firm pressure without gouging the plated contact surface. This latter phenomena can result in loose particles of material which can cause arcing or unstable operation of the cavity.

If the tubes are used in applications which call for severe shock or vibration the tube may be clamped in place by the knob or radiator, exerting pressure only on this part of the tube and against the tube stop. No other portion of the tube should be subject to any clamping force. In particular, electrical contacts which utilize set-screws or rigid clamps should be avoided. Such contact schemes can distort the contact surfaces causing undue stress in the metal-to-ceramic seal area which may result in a vacuum leak. Soldered electrical connections can be made, however great care should be taken during the solder operation to avoid fracture of the seal area due to thermal shock. All contact surfaces should be kept clean to minimize losses.

COOLING - The EIMAC planar triodes are designed to operate at envelope and anode temperatures of up to the maximum rated value of 250°C. However, performance and long-term reliability of any component are improved when it is kept as cool as technically feasible. Therefore, it is recommended that sufficient cooling be provided to keep the anode and seal areas well below the specified maximum temperature, where long tube life and high reliability are of great importance.

The maximum plate dissipation of the 8906AL/Y572AL is 10 watts average power. This can be accomplished by conduction, natural convection or forced air convection cooling. The maximum plate dissipation in pulse service is 45 watts average when furnished with EIMAC radiator (P/N 014224) and forced air cooling is employed at that level. When forced air cooling is used, it is recommended that additional airflow, apart from that flowing through the radiator be used to cool the tube envelope and other tube terminals. A certain amount of conduction cooling is usually inherent in the contact finger configuration. It should be noted, however, that spring fingers provide poor heat conduction and measurements have shown a temperature difference as much as 50°C between the contact finger and contact area.

It is suggested that in all new applications the envelope temperature be measured, especially if the tube is used close to the upper temperature limit. The temperature can easily be determined by the use of Tempilaq paint (Tempil Division, Big Three Industrial Gas & Equipment Co. Hamilton Blvd., So. Plainfield, N.J. 07080. or Temp-Plate stickers (Pydrodyne, Inc., 1001 Colorado St., Santa Monica, California 90404.)

ELECTRICAL

HEATER VOLTAGE - The rated heater voltage for the 8906AL/Y572AL is 5.7 volts and should be controlled within ±2% to obtain maximum tube life and to minimize variations in circuit performance. The rated heater voltage is optimum for most existing airborne applications such as DME and transponder systems. However, there are other applications where a different heater voltage than the nominal should be used to obtain the longest possible tube life. Depending on pulse width, power output and frequency of oscillation used a different heater voltage may be better for long reliable life. Electron transit time is not necessarily small with respect to the period of oscillation and the amount of driving power diverted will contribute to the cathode heating by electron bombardment.

The proper adjustment of the heater voltage must be made to compensate for this additional heating, which depends on operating frequency and duty cycle employed.

INTERELECTRODE CAPACITANCES - As indicated, the capacitance values are shown for measurements made with no heater voltage. The cathode to grid and cathode to plate capacitance will increase with the application of the heater voltage, due to the thermal expansion of the cathode support. Typically, the increase in the grid to cathode capacitance will be 15%, or more, depending on the heater voltage. Since the heater voltage can vary depending on use, data taken without heater voltage is more useful for control of tube-to-tube uniformity. The grid to anode capacitance is not effected by the application of the heater voltage.

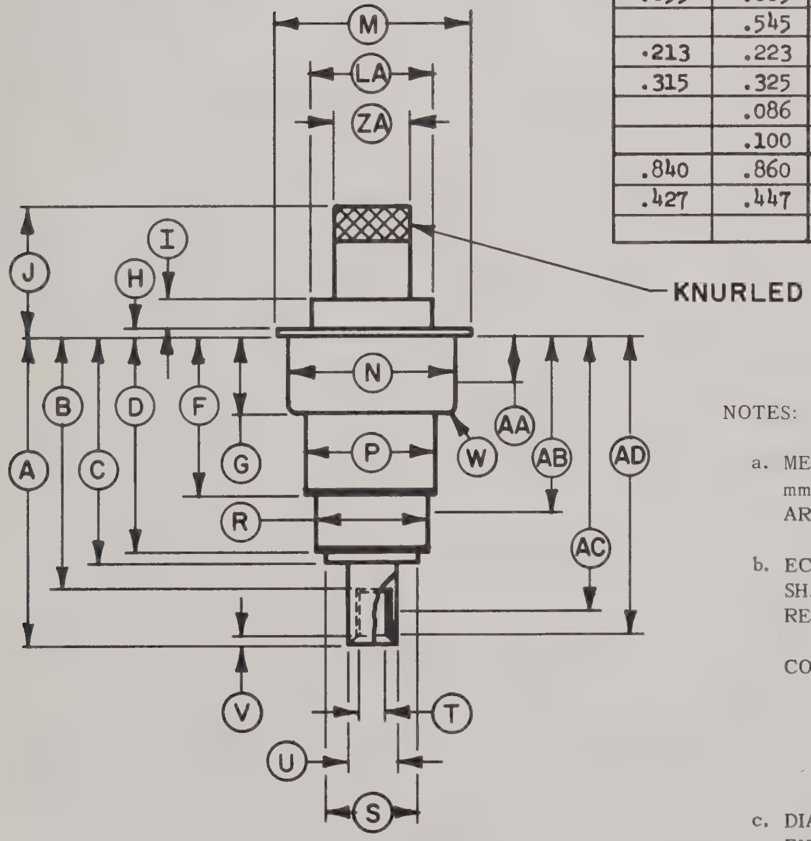
CIRCUIT TUNING - Especially under grid pulse conditions, it is important that the tube does not lose bias or momentarily go into a CW mode. Either of these events may result in tube failure. It is suggested that provision be made for initial circuit tune-up at reduced anode voltage and for extra tube protection when the circuit adjustment is critical. The average grid dissipation capability for this tube is 2.0 watts. For many applications the limiting factor is often not anode dissipation or cathode emission capability, but grid dissipation. If pulse width control is lost in pulse applications the grid can exceed safe operating temperatures in 50 ms or less. Appropriate circuit protection during tune up is therefore recommended.

CATHODE OPERATION - The 8906AL/Y572AL contains an arc-resistant cathode. Performance in the field and laboratory indicates this tube is capable of withstanding some abuse due to high voltage arcs, however, poor circuit adjustment in the field may result in shortened tube life. It is, therefore, suggested that wherever feasible, the plate supply be designed such that its impedance limits the short circuit current to within five to ten times the maximum forward current. For pulse service the peak current should be limited to the values listed. Higher pulse width and duty cycles than given can be obtained with proper derating of the current. For this and special applications it is recommended that the user request additional information pertaining to his special application from the nearest Varian Electron Tube and Devices Field Office, or the Product Manager, Eimac Division of Varian, Salt Lake City, Utah.

For general application information please refer to the Planar Triode Operating Instructions.

ELECTRODE CONTACT AREA				
DIM	MIN.	MAX.	MIN.	MAX.
AA	.035	.361	.89	9.17
AB	1.185	1.265	30.10	32.14
AC	1.534	1.728	38.96	43.89
AD	1.475	1.815	37.47	46.10
	DIM. IN INCHES		DIM. IN MILLIMETERS	

DIMENSION DATA					
DIM. IN INCHES			DIM. IN MILLIMETERS		
MIN.	MAX.	DIM	MIN.	MAX.	NOTES
1.185	1.875	A	46.10	47.62	
	1.534	B		38.96	
	1.475	C		37.46	
1.289	1.329	D	32.74	33.76	
.970	1.010	F	24.64	25.65	
.462	.477	G	11.73	12.12	
	.040	H		1.02	
	.185	I		4.70	
.766	.826	J	19.46	20.98	
1.180	1.195	M	29.97	30.35	
1.025	1.035	N	26.04	26.29	c
.752	.792	P	19.10	20.12	d
.655	.665	R	16.64	16.89	c
	.545	S		13.84	
.213	.223	T	5.41	5.66	c
.315	.325	U	8.00	8.26	c
	.086	V		2.18	
	.100	W		2.54	
.840	.860	LA	21.34	21.84	
.427	.447	ZA	10.75	11.35	



NOTES:

a. METRIC EQUIVALENTS, TO THE NEAREST .01 mm, ARE FOR GENERAL INFORMATION ONLY & ARE BASED UPON 1 inch = 25.4 mm.

b. ECCENTRICITY OF CONTACT SURFACES SHALL BE GAGED FROM CENTER LINE OR REFERENCE & SHALL BE AS FOLLOWS:

CONTACT SURFACE	TIR(MAX)	REFERENCE
ANODE	.020	CATHODE
GRID	.020	CATHODE
HEATER	.012	CATHODE

c. DIA'S N, R, T, & U SHALL APPLY THROUGHOUT ENTIRE LENGTH AS DEFINED BY DIM'S AA, AB, AC & AD RESPECTIVELY.

d. THIS SURFACE SHALL NOT BE USED FOR CLAMPING OR LOCATING.

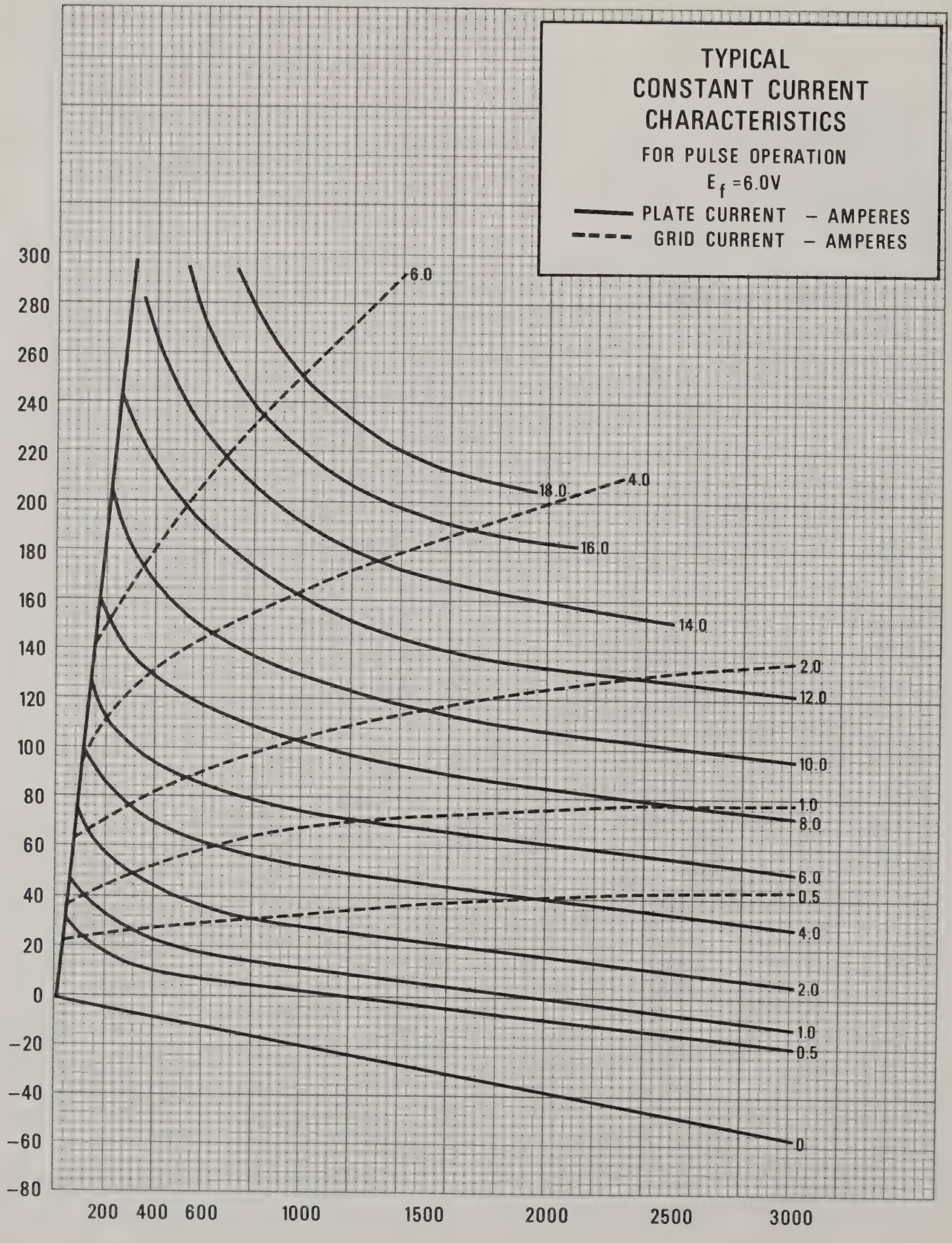
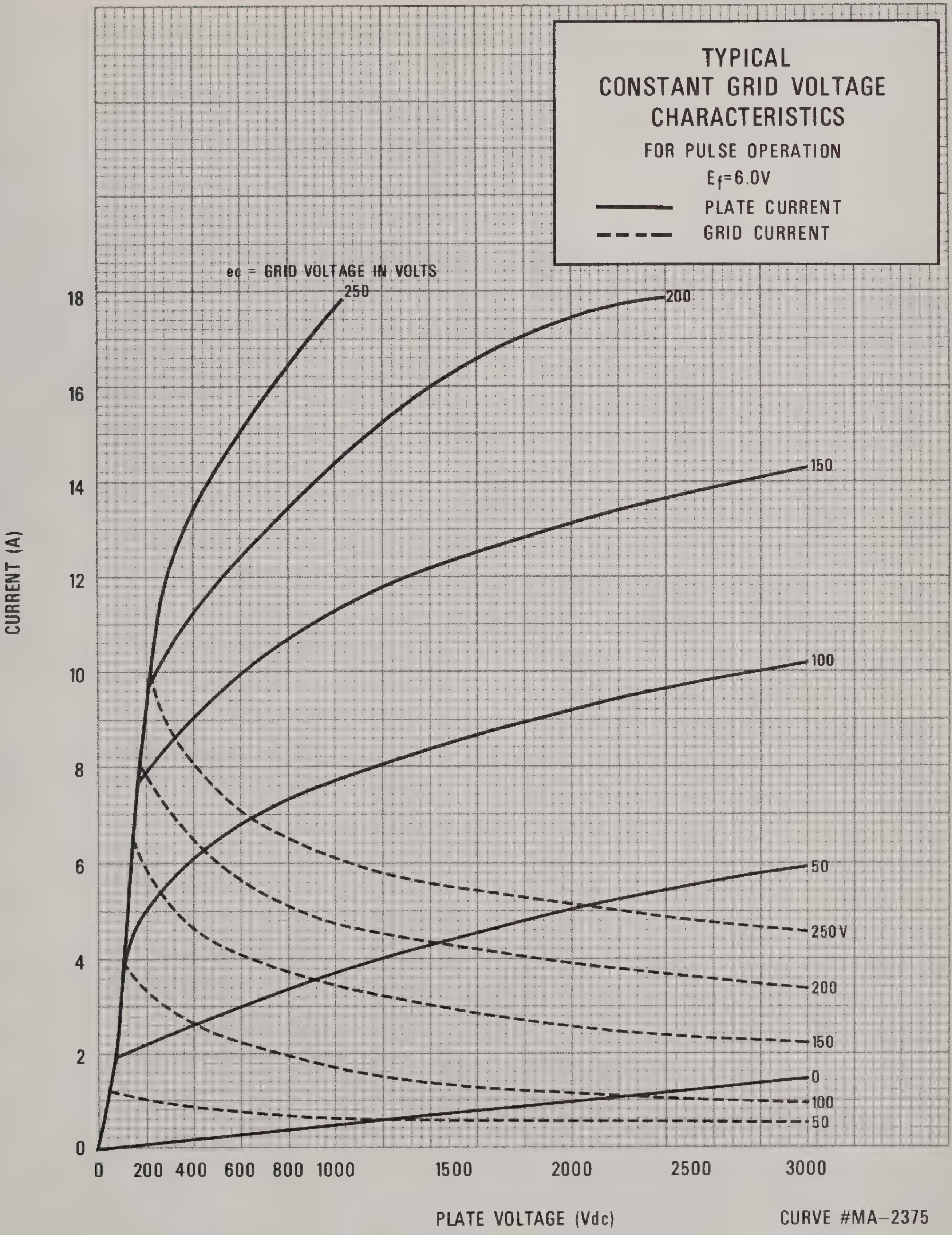
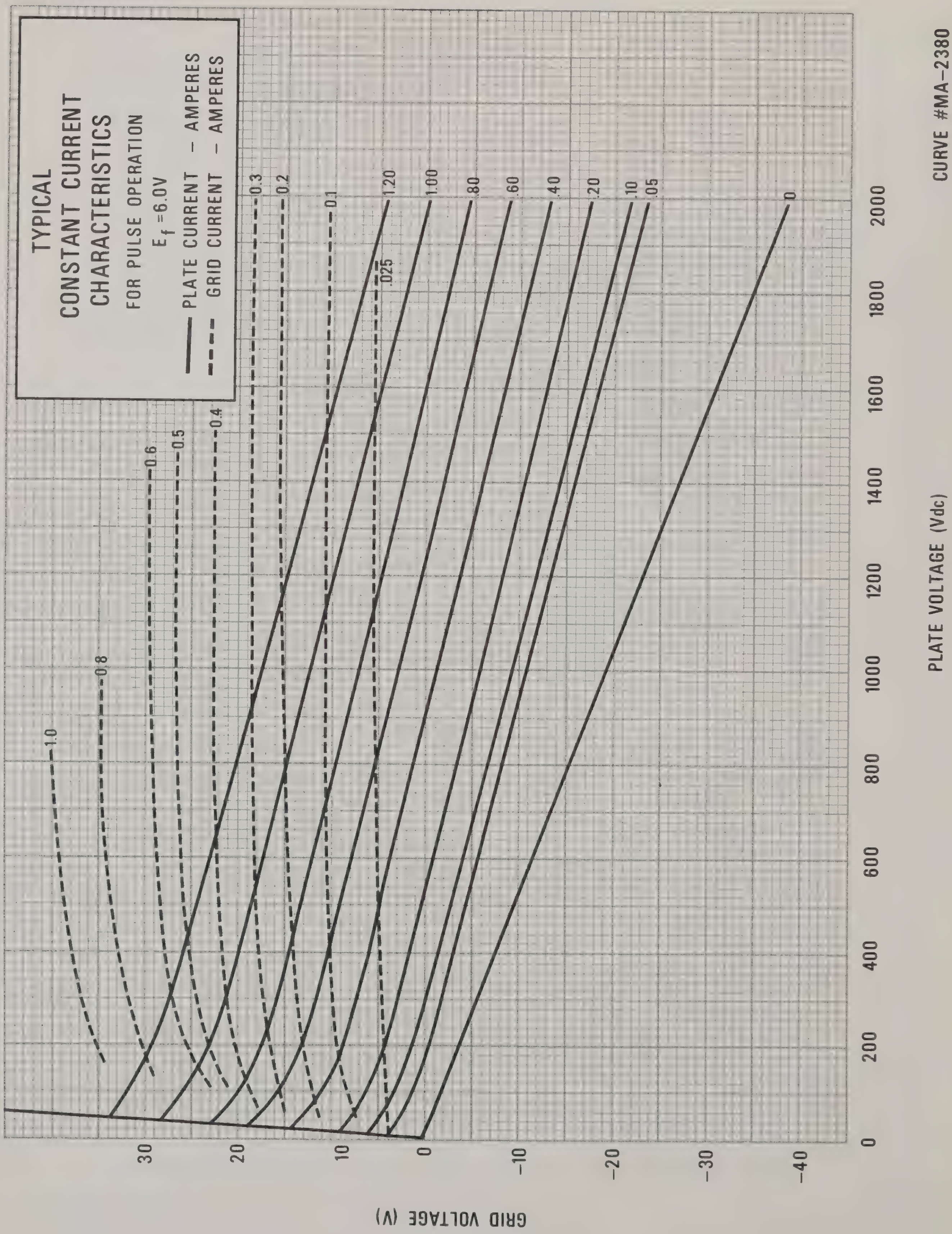


PLATE VOLTAGE (Vdc)

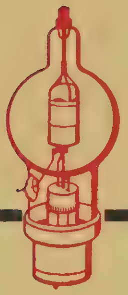
CURVE #MA–2374



CURVE #MA-2375



CURVE #MA-2380



triodes ▸

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IMPORTANT EIMAC "EXTRAS"

Application Engineering. The Eimac Application Engineering Department is available at all times for consultation. New tube operating techniques are continually being explored, tested and proved by Eimac application engineers, whose combined knowledge and experience are made available to you. Additional contributions by this Eimac department are its Application Bulletins, an expanding service which you get without obligation.

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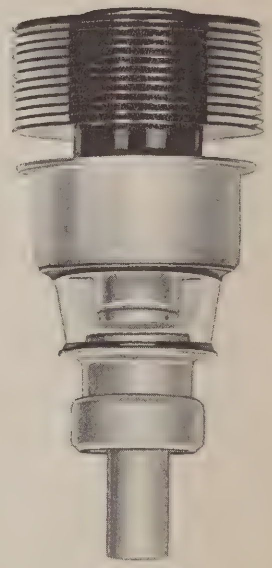
EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

2C39A

HIGH-MU TRIODE

Supersedes Types
2C38 - 2C39



▶ The Eimac 2C39A is a high-mu UHF transmitting triode with a plate-dissipation rating of 100 watts, designed for use as a power amplifier, oscillator, or frequency multiplier at frequencies to above 2500 Mc. The rugged construction, small size and unusually high transconductance of this tube make it ideal for compact fixed or mobile equipment. Its physical characteristics are particularly suitable for grid-isolation circuits and for cavity-type circuits.

The 2C39A in a class-C r-f grid-isolation circuit at 500 Mc. will deliver up to 27 watts useful power output with 6 watts driving power. As an r-f oscillator at 2500 Mc., the 2C39A will deliver a minimum of 12 watts useful power output.

GENERAL CHARACTERISTICS

ELECTRICAL

Cathode: Coated Unipotential	
Heater Voltage[1]	6.3 volts
Heater Current	1.0 ampere
Amplification Factor (Average)	100
Direct Interelectrode Capacitances (Average)	
Grid-Plate	1.95 $\mu\mu f$
Grid-Cathode	6.50 $\mu\mu f$
Plate-Cathode	0.035 $\mu\mu f$ max.
Transconductance ($I_b = 70$ma., $E_b = 600$v.)	22,000 μmhos
▶ Highest Frequency for Maximum Ratings	2500 Mc.

[1] See "Application".

▶ MECHANICAL

Base, Socket and Connections	See drawing
Mounting Position	Any
Cooling	Forced air
Maximum Temperature of Anode, Grid, Cathode and Heater Seals and Anode Cooler Core	175°C
Maximum Overall Dimensions:	
Length	2.75 inches
Diameter	1.26 inches
Net Weight	2.8 ounces
Shipping Weight (Average)	7 ounces

RADIO-FREQUENCY POWER AMPLIFIER, OSCILLATOR OR MODULATOR

MAXIMUM RATINGS (Per tube)

D-C PLATE VOLTAGE	1000 MAX. VOLTS
D-C CATHODE CURRENT	125 MAX. MA
D-C GRID VOLTAGE	—150 MAX. VOLTS
D-C GRID CURRENT	50 MAX. MA
HEATER VOLTAGE	SEE APPLICATION NOTES
INSTANTANEOUS PEAK POSITIVE GRID VOLTAGE	30 MAX. VOLTS
INSTANTANEOUS PEAK NEGATIVE GRID VOLTAGE	400 MAX. VOLTS
PLATE DISSIPATION	100 MAX. WATTS
GRID DISSIPATION	2 MAX. WATTS

TYPICAL OPERATION (Key-down conditions, per tube)
(Power-Amplifier Grid-Isolation Circuit, CW Operation, 500 Mc.)

D-C Plate Voltage	800 volts
D-C Grid Voltage	−20 volts
D-C Plate Current	80 ma
D-C Grid Current	32 ma
Driving Power (approx.)[1]	6 watts
Useful Power Output	27 watts

TYPICAL OPERATION
(R-F Oscillator, 2500 Mc.)[2]

D-C Plate Voltage	900 volts
D-C Grid Voltage	−22 volts
D-C Plate Current	90 ma
D-C Grid Current	27 ma
Useful Power Output	12 watts

PLATE-MODULATED RADIO-FREQUENCY AMPLIFIER OR OSCILLATOR

MAXIMUM RATINGS (Carrier conditions, per tube)

D-C PLATE VOLTAGE[3]	600 MAX. VOLTS
D-C GRID VOLTAGE	—150 MAX. VOLTS
D-C GRID CURRENT	50 MAX. MA
▶ D-C CATHODE CURRENT	100 MAX. MA
PEAK INSTANTANEOUS POSITIVE GRID VOLTAGE	30 MAX. VOLTS
PEAK INSTANTANEOUS NEGATIVE GRID VOLTAGE	400 MAX. VOLTS
PLATE DISSIPATION	70 MAX. WATTS
GRID DISSIPATION	2 MAX. WATTS

TYPICAL OPERATION
(Plate-Modulated Radio-Frequency Power Amplifier Grid-Isolation Circuit, 500 Mc., Per Tube)

D-C Plate Voltage	600 volts
D-C Grid Voltage	—16 volts
D-C Plate Current	75 ma
D-C Grid Current	40 ma
Driving Power (approx.)[1]	6 watts
Useful Carrier Power Output	18 watts

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[1] Driving power listed is the total power which must be supplied to a practical grid circuit at the frequency shown.

▶ [2] These 2500-Mc. conditions conform to the minimum requirements of the JAN-1A specifications for the 2C39A.

[3] For less than 100% modulation, higher d-c plate voltage may be used if the sum of the peak positive modulating voltage and the d-c plate voltage does not exceed 1200 volts.

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER "TYPICAL OPERATION", POSSIBLY EXCEEDING THE MAXIMUM RATINGS GIVEN FOR CW SERVICE, WRITE EITEL-McCULLOUGH, INC., FOR INFORMATION AND RECOMMENDATIONS.

(Effective 6-2-52) Copyright 1952 by Eitel-McCullough, Inc.

▶ Indicates change from sheet dated 6-15-51

APPLICATION

▶

MECHANICAL

Mounting—The 2C39A may be operated in any position. It should seat against the "anode flange" (see outline drawing), and any clamping action intended to hold the tube in its socket against vibration should also be applied to this flange. No seating or clamping pressure should be exerted against any other surface.

Connections—The tube terminals are in the form of concentric cylinders having graduated diameters, as illustrated in the outline drawing. Spring collets or fingers should be fitted to these cylindrical surfaces to make contact with the anode, grid, cathode and heater terminals. It is important to maintain good electrical contact by keeping these surfaces clean and by providing adequate contact area and spring pressure.

Cooling—Forced air must be supplied to the anode, grid, cathode and heater seals and to the anode cooler core in sufficient quantities to limit their temperatures to 175°C. A convenient accessory for the measurement of tube temperatures is "Tempilaq", a temperature-sensitive lacquer manufactured by the Tempil Corporation, 132 West 22nd St., New York 11, N. Y.

A suitable arrangement for an anode cooling cowl is shown in conjunction with the outline drawing. For operation at maximum rated dissipation, an air flow through this cowling of 12.5 cubic feet per minute is recommended; less cooling air may be used at low plate dissipations, provided only that seal and anode cooler core temperatures are not allowed to exceed 175°C.

At ambient temperatures greater than 25°C., or at altitudes higher than sea level, more air will be required to accomplish equivalent cooling. Further information on this subject is contained in an article by A. G. Nekut, "Blower Selection for Forced-Air Cooled Tubes", Electronics, August, 1950.

ELECTRICAL

Heater Voltage—The heater of the 2C39A is designed to be operated at 6.3 volts, with variations held within the range of 5.7 to 6.9 volts. This operating voltage is particularly recommended for pulse applications requiring in excess of 3.0 amperes of peak cathode current.

Tube life may be materially increased by operation of the heater at 5.3 volts, with variations held within the range of 4.8 to 5.8 volts. This operating voltage should be used whenever the peak cathode current is not required to exceed 3.0 amperes, and whenever transit-time effects contribute back heating to the cathode. Back heating is a function of frequency, grid bias and excitation (grid current), load impedance, power output and circuit design and adjustment.

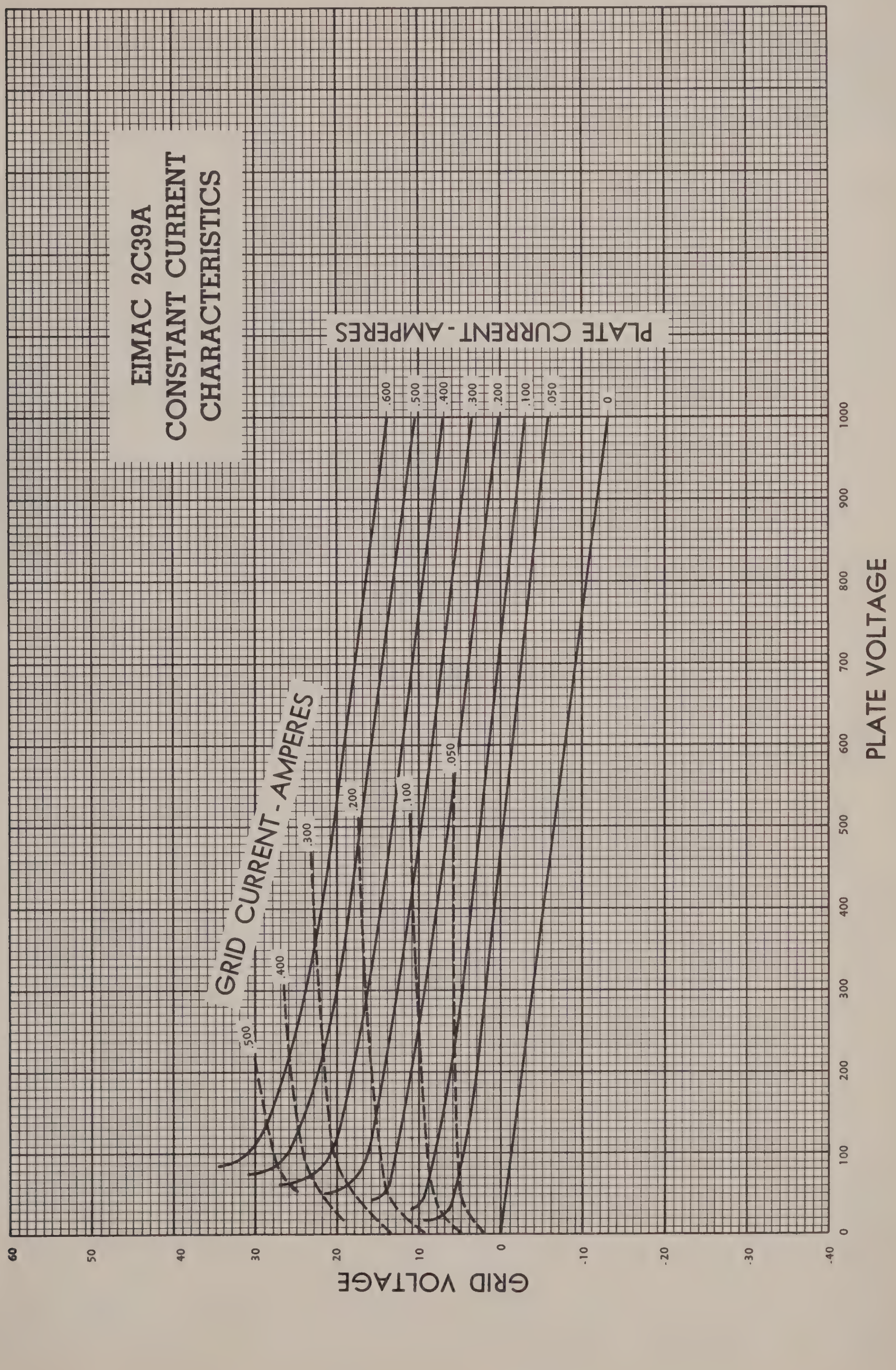
Cavity Circuits—Information regarding the design of cavities suitable for the 2C39A is widely available. One source is the material on cavity design for the 2C38 and 2C39 contained in "Very High Frequency Techniques", Radio Research Laboratory Staff, McGraw-Hill Co., 1947, Vol. 1, Chapter 15, pp. 337-375.

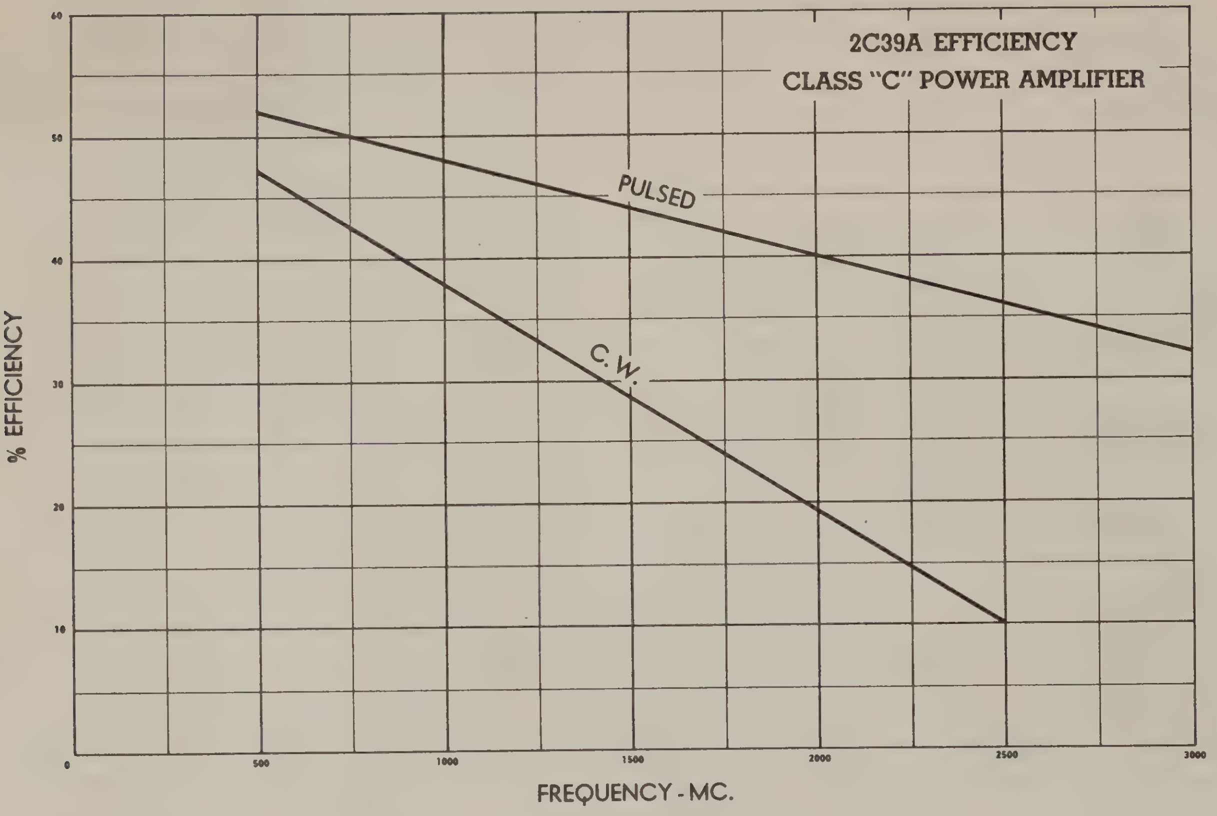
Operation—Low-voltage, high-current operation is preferable to high-voltage, low-current operation, from the standpoint of optimum tube life.

An excellent indication of operating conditions is the ratio of grid current to plate current; when the 2C39A is operated with grid-current values greater than half those of the plate current, either the drive is excessive or the plate loading is too light for the excitation present. The tube should never be operated without a load, or lightly loaded, even for short periods of time, and drive should be held to the lowest value consistent with reasonable efficiency.

When grid-leak bias is used, suitable means must be provided to protect the tube against loss of excitation at plate voltages in excess of 800 volts, and the grid-leak resistor should be made variable to facilitate maintaining the bias voltage and plate current at the desired values when tubes are changed in the equipment.

▶ Indicates change from sheet dated 6-15-51


EIMAC 2C39A
CONSTANT CURRENT
CHARACTERISTICS
PLATE CURRENT - AMPERES
.600
.500
.400
.300
.200
.100
.050
0
GRID CURRENT - AMPERES
.500
.400
.300
.200
.100
.050
PLATE VOLTAGE
0
100
200
300
400
500
600
700
800
900
1000
GRID VOLTAGE
60
50
40
30
20
10
0
-10
-20
-30
-40



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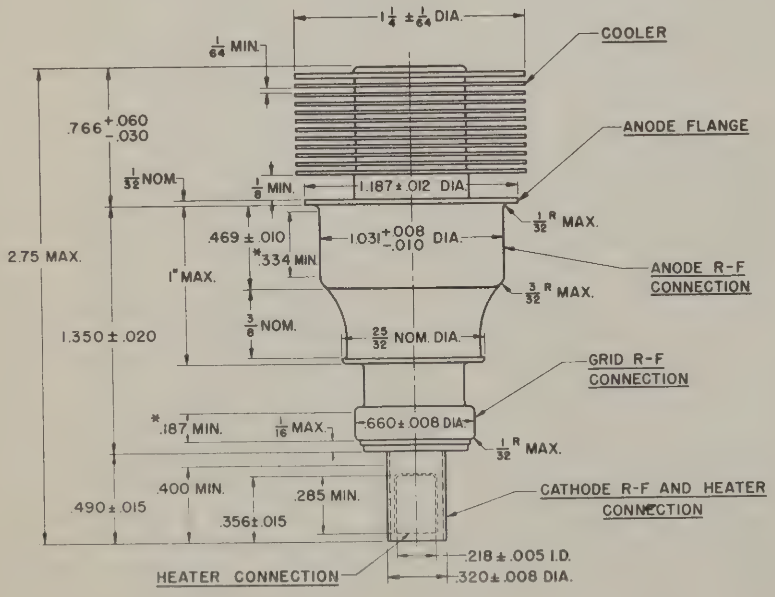

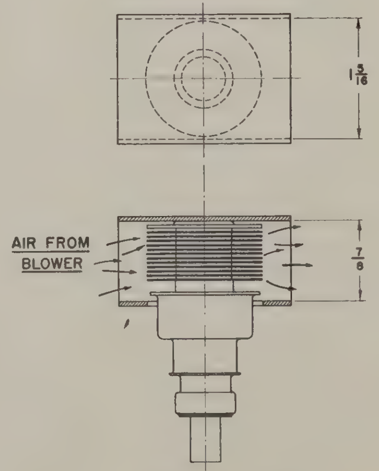

RECOMMENDED COWLING
FOR
FORCED-AIR COOLING
OF ANODE

DIMENSIONS
IN INCHES

*CLEAN & SMOOTH AREA
AVAILABLE FOR CONTACT

▶ Indicates change from sheet dated 6-15-51

Printed in U. S. A. 5-A2-64814

Eimac®

EITEL-McCULLOUGH, INC.
SAN CARLOS · CALIFORNIA

2C39B
TRIODE

IMPORTANT

Effective March 1, 1959 the 2C39B is replaced by the 3CX100A5 in the Eimac line. The 3CX100A5 is a superior all-ceramic planar UHF triode unilaterally interchangeable with the 2C39B and tested to more stringent electrical tolerances.

Please consult the 3CX100A5 data sheet in this catalog for electrical and mechanical characteristics.

Effective March 1, 1959

Printed in U.S.A. 62306

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

3C24

MEDIUM-MU TRIODE

•

MODULATOR
OSCILLATOR
AMPLIFIER

▶ The Eimac 3C24 is a medium-mu, power triode intended for use as an amplifier, oscillator or modulator. It has a maximum plate dissipation rating of 25 watts and can be operated at its maximum ratings at frequencies up to 60 megacycles.

The 3C24 is cooled by radiation from the plate and by air circulation around the envelope. The plate operates at a visible red color at maximum rated dissipation.

This tube is identical to the 25T except that the grid terminal is located at the side of the envelope instead of the base.

GENERAL CHARACTERISTICS

▶ ELECTRICAL

Filament: Thoriated tungsten

Voltage	6.3 volts
Current	3.0 amperes
Amplification Factor (Average)	24

Direct Interelectrode Capacitances (Average)

Grid-Plate	1.6 $\mu\mu$f
Grid-Filament	1.7 $\mu\mu$f
Plate-Filament	0.2 $\mu\mu$f
Transconductance (i_b=25 ma., E_b=1000 v.)	2500 μmhos
Frequency for Maximum Ratings	60 Mc.

▶ MECHANICAL

Base	UX Small 4-pin

Basing - Fits E. F. Johnson Co. No. 122-224, National Co. No. XC-4 or CIR-4, or equivalent socket

Mounting	Vertical, base down or up
Cooling	Convection and Radiation

Recommended Heat Dissipating Connector:

Plate	HR-1
Grid	HR-1

Maximum Over-all Dimensions:

Length	4.38 inches
Diameter	1.44 inches
Net Weight	1.5 ounces
Shipping Weight (Average)	1.0 pound

▶ AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class-B and AB

MAXIMUM RATINGS, PER TUBE

D-C PLATE VOLTAGE	2000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT	75 MAX. MA.
PLATE DISSIPATION	25 MAX. WATTS
GRID DISSIPATION	7 MAX. WATTS

TYPICAL OPERATION, CLASS AB_2
Sinusoidal wave, two tubes unless otherwise specified

D-C Plate Voltage	750	1000	1250	Volts
D-C Grid Voltage (approx.)*	—20	—30	—42	Volts
Zero-Signal D-C Plate Current	43	32	24	Ma.
Max-Signal D-C Plate Current	127	127	130	Ma.
Effective Load, Plate-to-Plate	12,000	17,000	21,400	Ohms
Peak A-F Grid Input Voltage (per tube)	110	120	135	Volts
Max-Signal Peak Driving Power	5.5	6.0	6.8	Watts
Max-Signal Nominal Driving Power (approx.)	2.8	3.0	3.4	Watts
Max-Signal Plate Power Output	60	85	112	Watts

*Adjust to give stated zero-signal plate current.

▶ PLATE MODULATED RADIO FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	1600 MAX. VOLTS
D-C PLATE CURRENT	60 MAX. MA.
PLATE DISSIPATION	17 MAX. WATTS
GRID DISSIPATION	7 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	1000	1250	1600	Volts
D-C Plate Current	60	60	53	Ma.
D-C Grid Voltage	—120	—140	—170	Volts
D-C Grid Current	14	13	11	Ma.
Peak R-F Grid Input Voltage	235	255	280	Volts
Driving Power	3.3	3.3	3.1	Watts
Grid Dissipation	1.6	1.5	1.2	Watts
Plate Power Input	60	75	85	Watts
Plate Dissipation	13	15	17	Watts
Plate Power Output	47	60	68	Watts

The above figures show actual measured tube performance and do not allow for variations in circuit losses.

▶ RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony (Key-down conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	2000 MAX. VOLTS
D-C PLATE CURRENT	75 MAX. MA.
PLATE DISSIPATION	25 MAX. WATTS
GRID DISSIPATION	7 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	1000	1500	2000	Volts
D-C Plate Current	72	67	63	Ma.
D-C Grid Voltage	—70	—95	—130	Volts
D-C Grid Current	9	13	18	Ma.
Peak R-F Grid Input Voltage	170	195	245	Volts
Driving Power	1.3	2.2	4.0	Watts
Grid Dissipation	.9	1.3	2.1	Watts
Plate Power Input	72	100	125	Watts
Plate Dissipation	25	25	25	Watts
Plate Power Output	47	75	100	Watts

The above figures show actual measured tube performance and do not allow for variations in circuit losses.

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▶ Indicates change from sheet dated 8-15-44.

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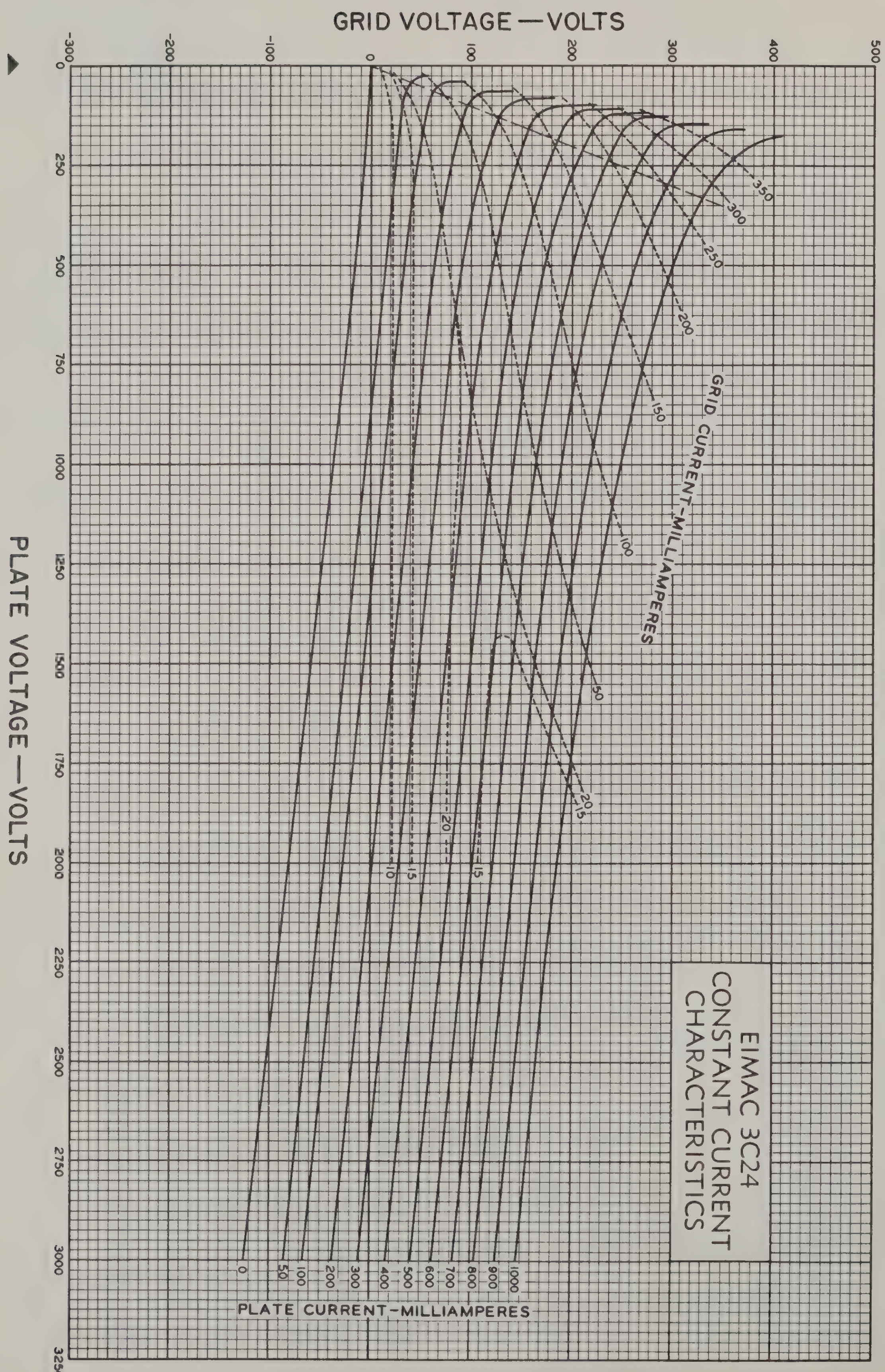

EIMAC 3C24
CONSTANT CURRENT
CHARACTERISTICS

▶ Indicates change from sheet dated 8-15-44.

DRIVING POWER vs. POWER OUTPUT

The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 1000, 1500 and 2000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 1000, 1500, and 2000 volts respectively.

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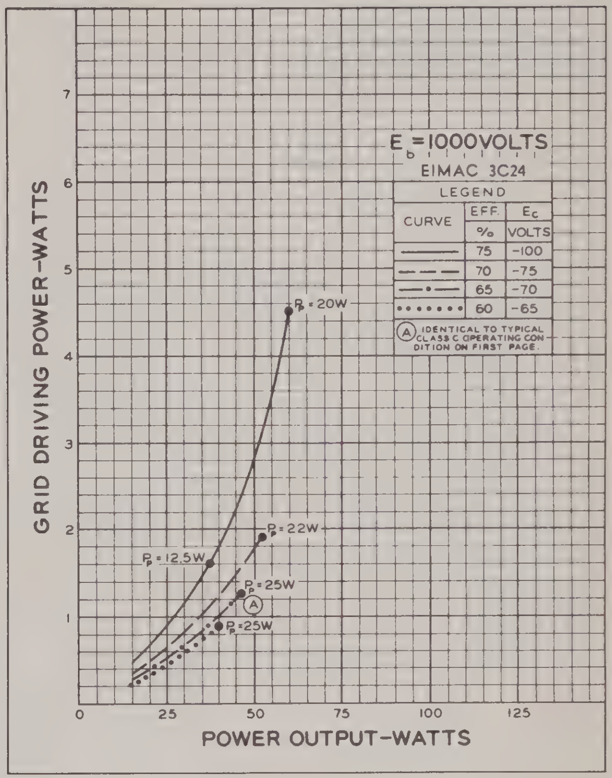

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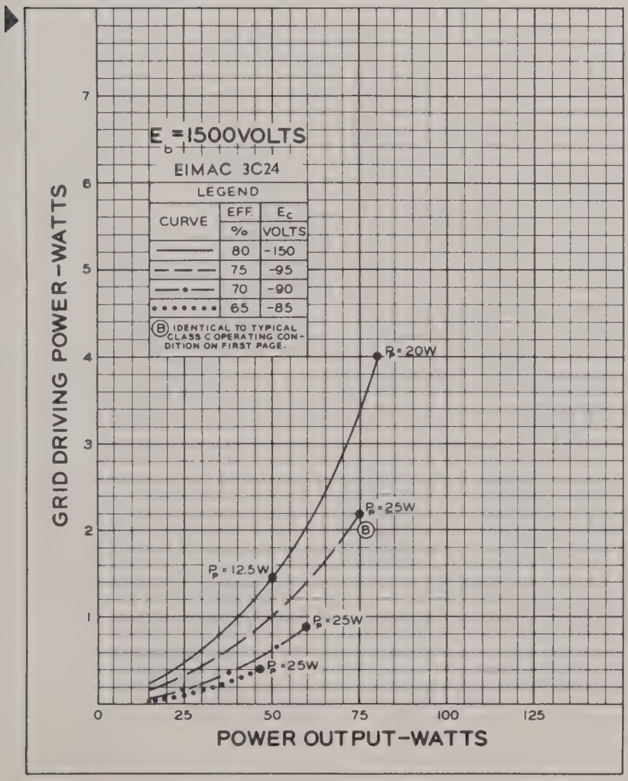

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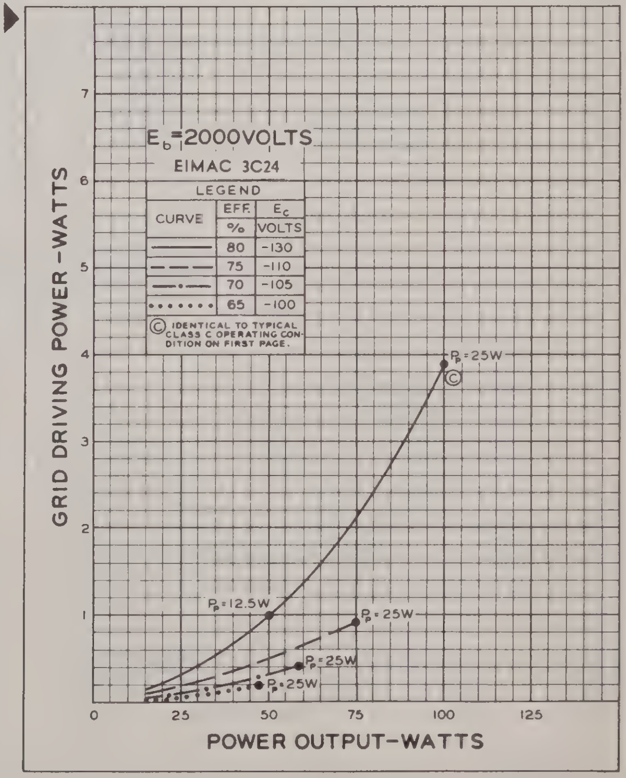

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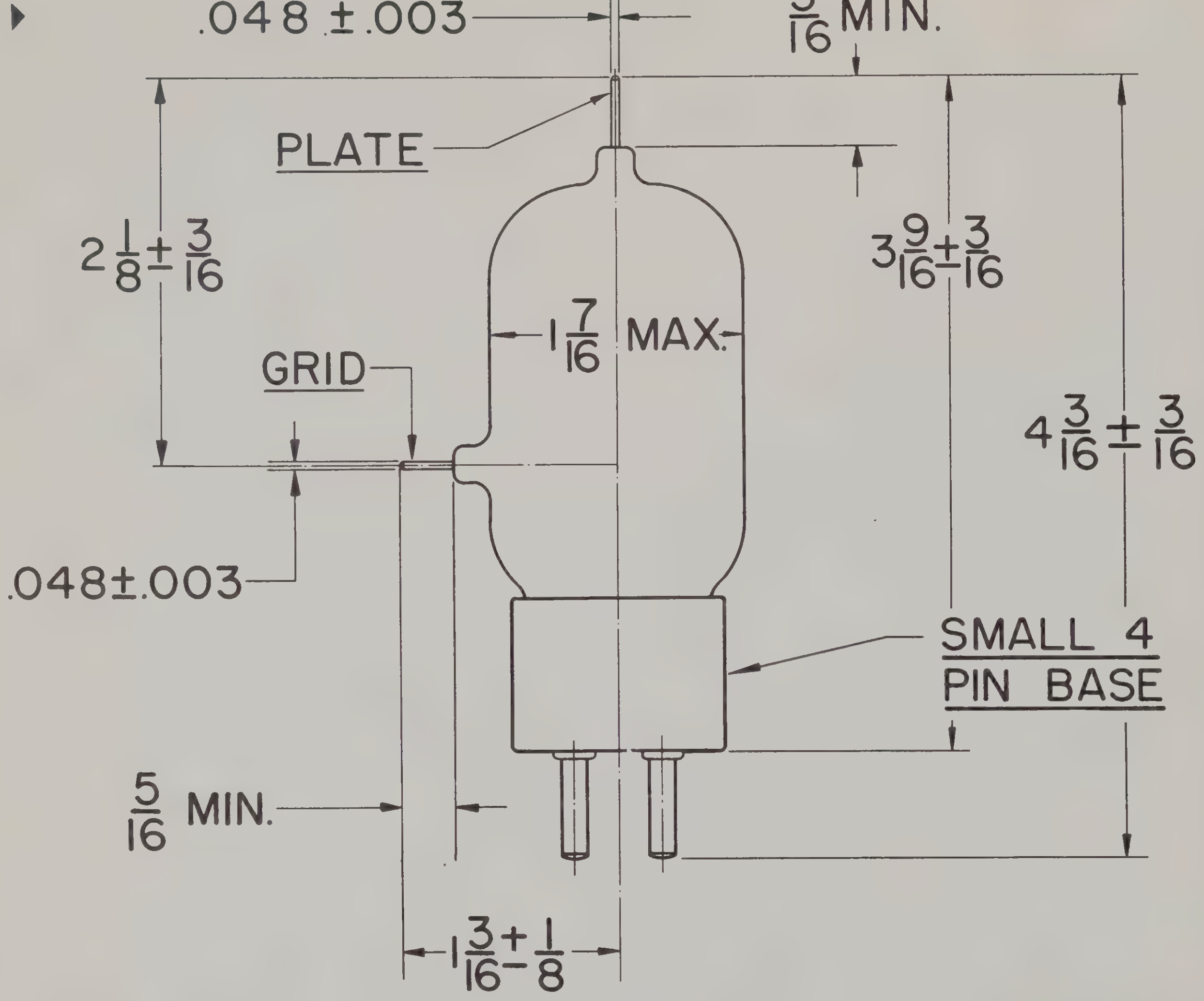
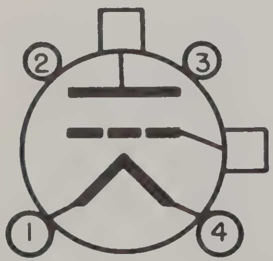
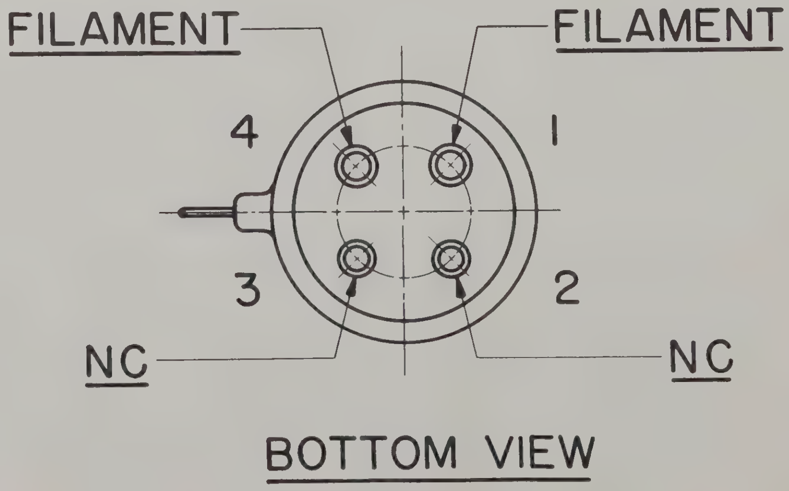






▶ Indicates change from sheet dated 8-15-44.

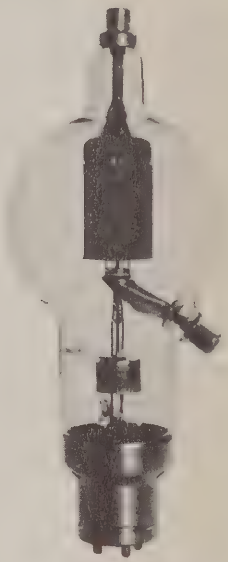
EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

6C21

PULSE TRIODE
MODULATOR AMPLIFIER

The Eimac 6C21 is a high-vacuum power triode designed for pulse-modulator service at d-c plate voltages up to 30 kilovolts and peak plate currents as high as 15 amperes.

The 6C21 is forced-air and radiation cooled, has a maximum plate-dissipation rating of 300 watts, and, in pulse modulator service, will deliver up to 375 kilowatts to a resistive load with 7.5 kilowatts of driving power.



GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten	
Voltage	8.2 volts
Current	17.0 amperes
Amplification Factor (Average)	30
Direct Interelectrode Capacitances (Average)	
Grid-Plate	4.3 μμf
Input	9.5 μμf
Output	0.7 μμf
Transconductance (I_b=100 ma., E_b=2000v.)	6100 μmhos

MECHANICAL

Base	50-watt jumbo 4-pin
Connections	See drawing
Socket	E. F. Johnson Co. 123-211, National Co. XM-50 or equivalent.
Mounting Position	Vertical, base down or up
Cooling	Forced Air and Radiation
Maximum Temperature of Grid & Plate Seals	225° C.
Recommended Heat Dissipating Plate and Grid Connectors	Eimac HR-8
Maximum Overall Dimensions:	
Length	12-⅝ inches
Diameter	5-⅛ inches
Net Weight	1.3 pounds
Shipping Weight	5.8 pounds

MAXIMUM RATINGS

Pulse Modulator Service (Per Tube)

D-C PLATE VOLTAGE	30 MAX. KILOVOLTS
D-C GRID VOLTAGE	-2.0 MAX. KILOVOLTS
PEAK POSITIVE PLATE VOLTAGE	35 MAX. KILOVOLTS
PEAK POSITIVE GRID VOLTAGE	1.6 MAX. KILOVOLTS
PEAK PLATE CURRENT	15 MAX. AMPERES
AVERAGE GRID DISSIPATION	50 MAX. WATTS
AVERAGE PLATE DISSIPATON	300 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	28 kilovolts
D-C Grid Voltage	-1.5 kilovolts
Pulse Plate Current	15 amperes
Pulse Grid Current*	3.0 amperes
Pulse Positive Grid Voltage	1000 volts
Pulse Grid Driving Power*	7.5 kilowatts
Load: Resistive	1650 ohms
Duty	.002
Pulse Voltage Output	25 kilovolts
Pulse Power Input	420 kilowatts
Pulse Plate Dissipation	45 kilowatts
Pulse Power Output	375 kilowatts

*Approximate values.

(Effective 4-1-54) Copyright 1954 by Eitel-McCullough, Inc.

APPLICATION

Mounting—The 6C21 must be mounted vertically, base down or up. The leads to the plate and grid terminals should be flexible, and the tube must be protected from vibration and shock.

Cooling—Forced-air cooling of the filament stem structure is required. Base cooling requires a minimum air flow of 2½ cubic feet per minute directed through the tube base toward the filament press. If the hole in the socket is at least 1 inch in diameter and the manifold is the same diameter, a static pressure of ¼ inch of water is required at the manifold to provide the 2½ cubic feet per minute. Heat Dissipating Connectors (Eimac HR-8 or equivalent) must be used at the plate and grid terminals and unobstructed circulation of air around the tube is required in sufficient quantity to prevent the temperatures of grid and plate seals from exceeding 225°C. Forced ventilation of compartments or equipment in which the tube is located is always beneficial, though not necessarily required.

Tube temperatures may be measured with the aid of "Tempilaq", a temperature-sensitive lacquer manufactured by the Tempil Corporation, 132 West 22nd Street, New York 11, N. Y. For satisfactory results, Tempilaq must be sprayed on the surface to be measured in a thin coat, covering as small an area as will serve the purpose.

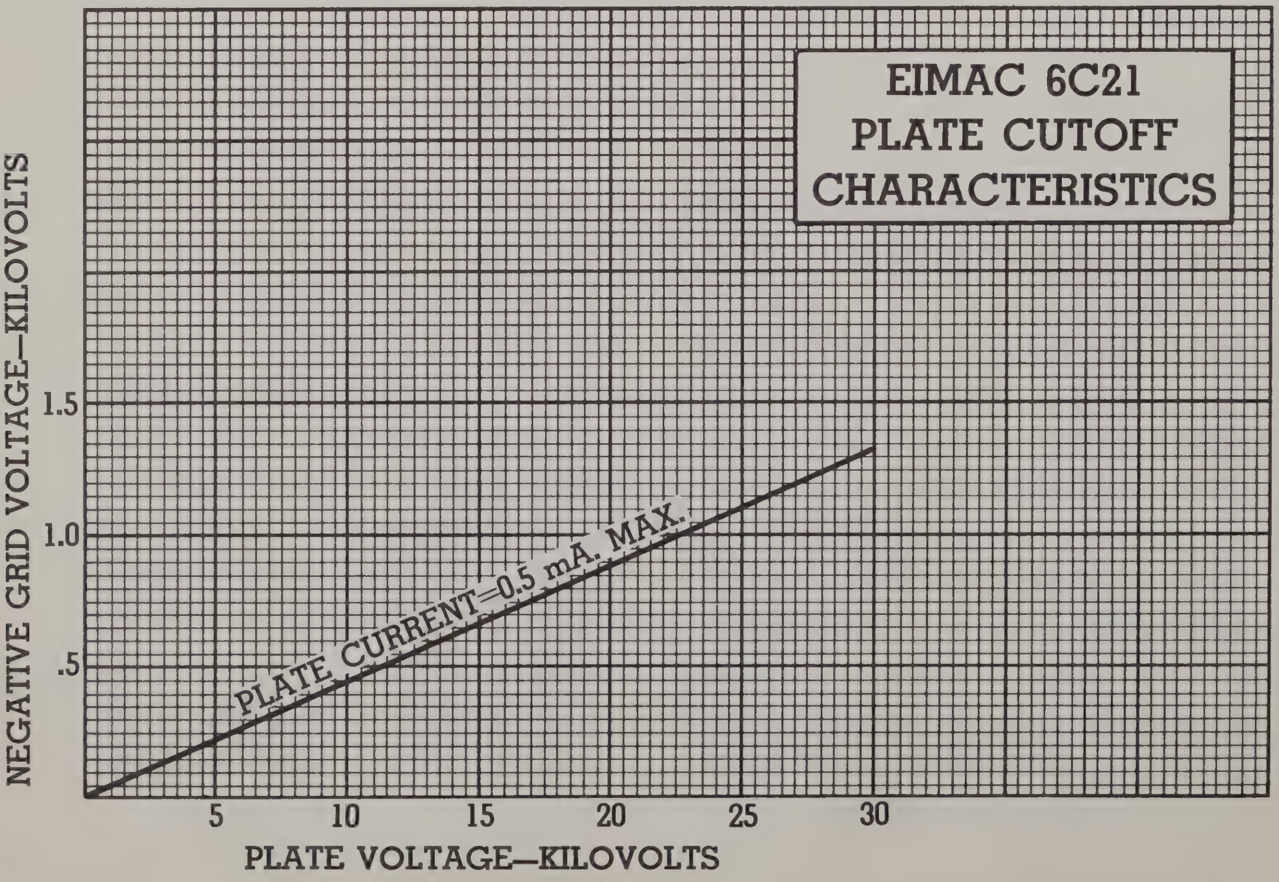
ELECTRICAL

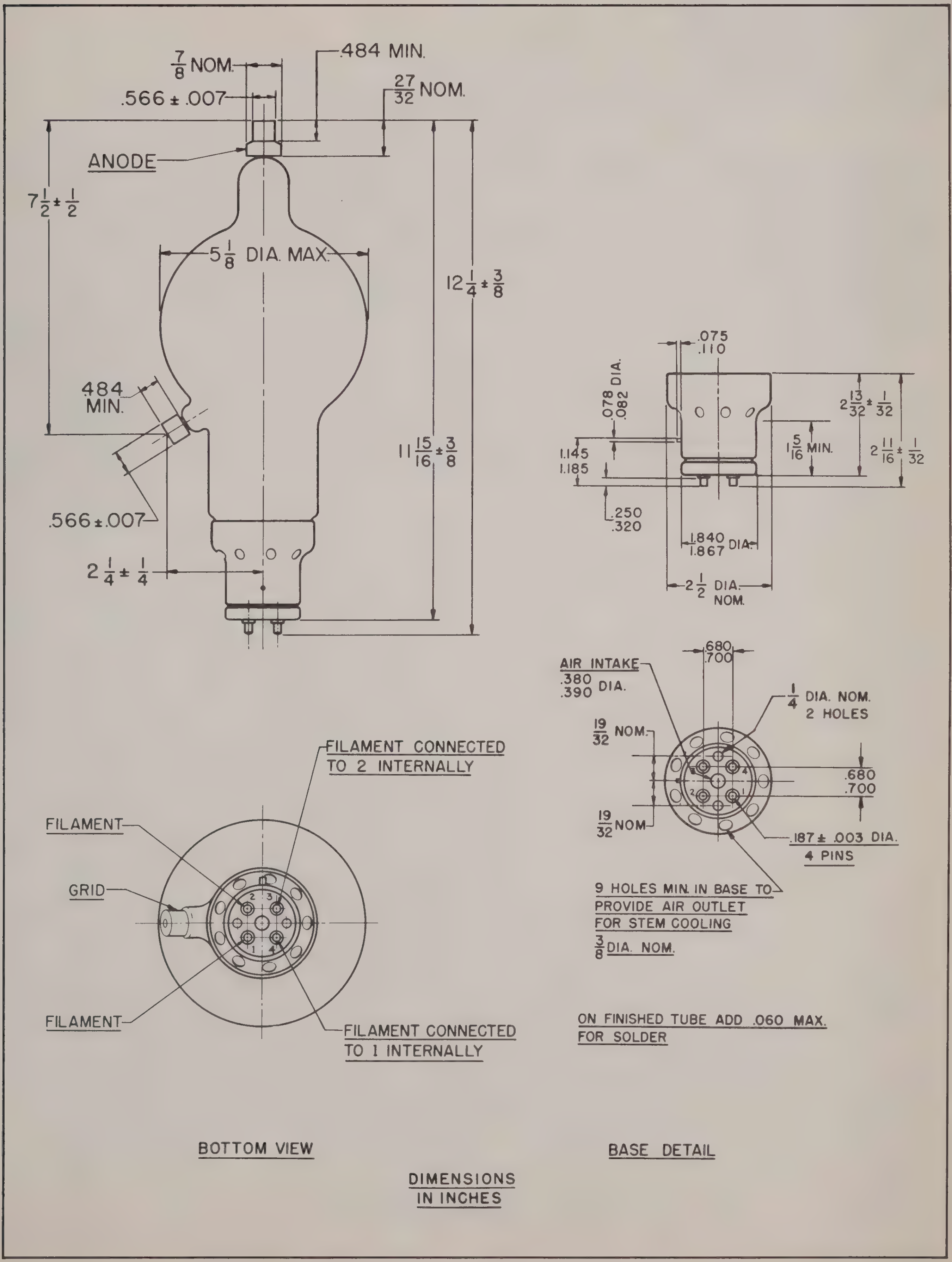
Filament Voltage—For optimum tube life the filament voltage, as measured directly at the base pins, should be the rated value of 8.2 volts. Variations should be kept within the range of 7.9 to 8.5 volts. All four socket terminals should be used, with two placed in parallel for each filament connection.

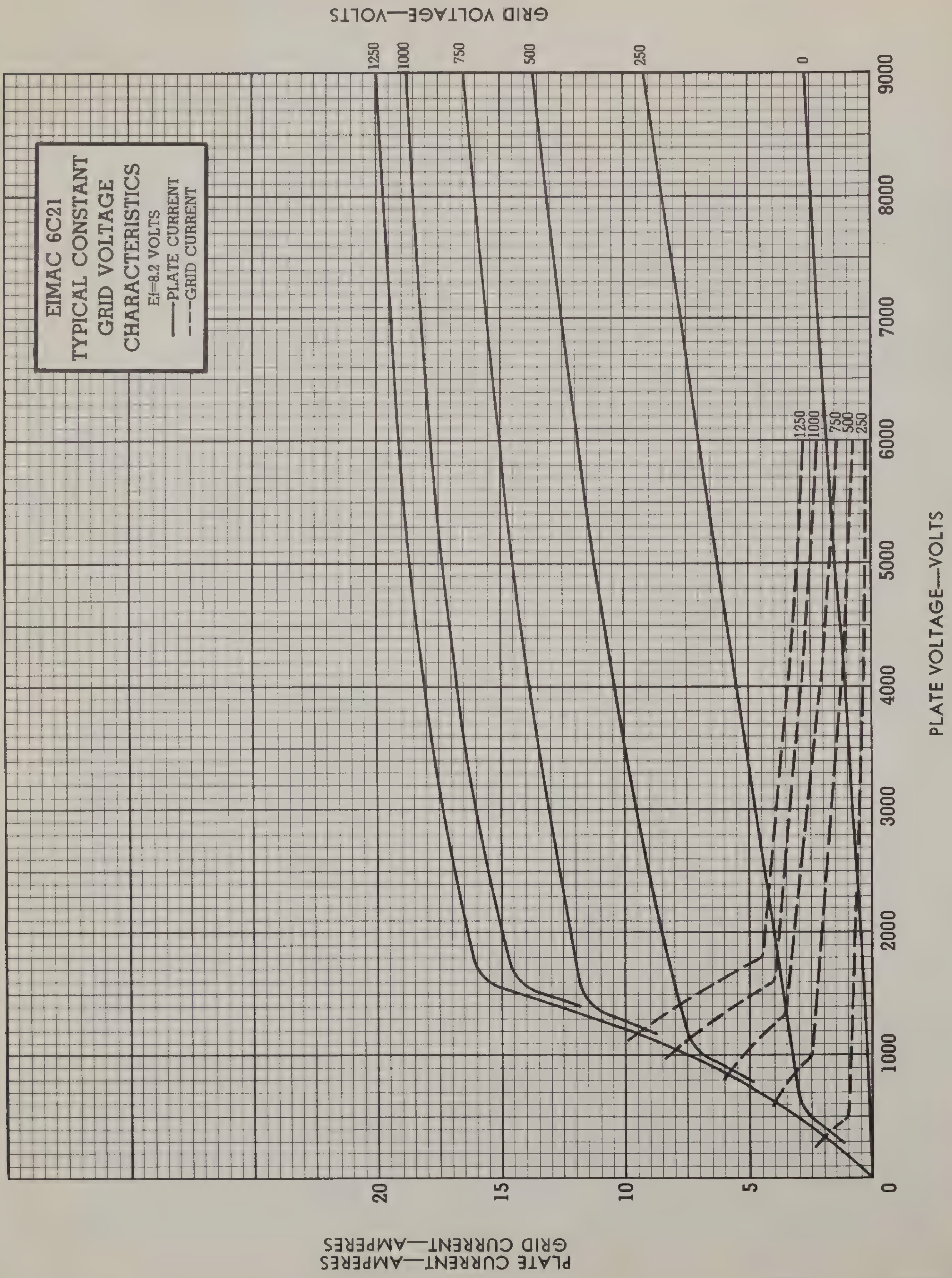
Plate Dissipation—Under normal operating conditions, the plate dissipation should not be allowed to exceed the maximum rating of 300 watts. Plate dissipation in excess of the maximum rating is permissable for short periods of time, such as during adjustment procedures.

Operation—The 6C21 may be operated with inductive or resistive loads, provided only that the maximum ratings are not exceeded. The ratings listed for pulse modulator service are for operation at peak plate currents of 15 amperes and pulse lengths up to 100 milliseconds. Further information on pulse operation, such as tube limitations under long (100 milliseconds or more) pulse conditions, is contained in "Pulse Service Notes" obtainable from Eitel-McCullough, Inc., on request. If it is desired to operate the 6C21 under conditions widely different from those given for pulse modulator service, write Eitel-McCullough, Inc., for information and recommendations.

Useful information about pulse circuits may be obtained from such publications as "Pulse Generators", volume 5 of the MIT Radiation Laboratory Series, published by McGraw-Hill, 1948.




7/8 NOM.
.484 MIN.
.566 ± .007
27/32 NOM.
ANODE
7 1/2 ± 1/2
5 1/8 DIA. MAX.
12 1/4 ± 3/8
484 MIN.
11 15/16 ± 3/8
.566 ± .007
2 1/4 ± 1/4
.075
.110
.078
.082 DIA.
2 13/32 ± 1/32
1 5/16 MIN.
2 11/16 ± 1/32
1.145
1.185
.250
.320
1.840
1.867 DIA.
2 1/2 DIA. NOM.
.680
.700
AIR INTAKE
.380
.390 DIA.
1/4 DIA. NOM. 2 HOLES
19/32 NOM.
19/32 NOM.
.680
.700
.187 ± .003 DIA. 4 PINS
9 HOLES MIN. IN BASE TO PROVIDE AIR OUTLET FOR STEM COOLING
3/8 DIA. NOM.
FILAMENT CONNECTED TO 2 INTERNALLY
FILAMENT
GRID
FILAMENT
FILAMENT CONNECTED TO 1 INTERNALLY
1
2
3
4
ON FINISHED TUBE ADD .060 MAX. FOR SOLDER
BOTTOM VIEW
BASE DETAIL
DIMENSIONS IN INCHES


EIMAC 6C21
TYPICAL CONSTANT
GRID VOLTAGE
CHARACTERISTICS
Ef=8.2 VOLTS
——PLATE CURRENT
- - -GRID CURRENT
GRID VOLTAGE—VOLTS
1250
1000
750
500
250
0
1250
1000
750
500
250
PLATE VOLTAGE—VOLTS
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
PLATE CURRENT—AMPERES
GRID CURRENT—AMPERES
0
5
10
15
20

Eimac®

EITEL-McCULLOUGH, INC.
SAN CARLOS · CALIFORNIA

TENTATIVE DATA

3CX100A5

HIGH-MU UHF TRIODE

The Eimac 3CX100A5 is a ceramic-and-metal planar UHF triode intended to supersede any of the 2C39 types. It is manufactured to exacting dimensional tolerances to provide the greatest mechanical uniformity. Extended and critical electrical testing result in increased reliability and a minimum variation in electrical characteristics. Full ratings apply at altitudes up to 60,000 feet and it is capable of sustained, reliable operation at elevated temperatures.

The mechanical and electrical characteristics of the 3CX100A5 make it a desirable tube for grid isolation circuits in cavity devices. It will deliver 27 watts of useful power at 500 megacycles and at 2900 megacycles, 9.5 watts of useful power can be realized.

GENERAL CHARACTERISTICS

ELECTRICAL

Cathode: Oxide Coated, Unipotential

	MIN.	NOM.	MAX.	
Heating Time			60	Seconds
Heater				
Voltage (see applications)	....	6.0	....	Volts
Current (E_f = 6.0 volts)	0.90	....	1.05	Amperes
Amplification Factor	....	100	....	
Transconductance (I_b = 70 Milliamperes)	....	25,000	....	Micromhos
Direct Interelectrode Capacitance				
C_{gk}	5.6	....	7.0	mmf.
C_{gp}	1.95	....	2.15	mmf.
C_{pk}	....	....	0.035	mmf.
Frequency for Maximum Ratings	....	....	2500	Megacycles

MECHANICAL

Terminals: Graduated Cylindrical Surfaces

Maximum Operating Temperatures	
Ceramic to Metal Seals	250°C (300°C short term overload value)
Anode Core	250°C (300°C short term overload value)
Operating Position	Any
Cooling	Forced Air
Maximum Overall Dimensions	
Length	2.701 Inches Max.
Diameter	1.264 Inches Max.
Net Weight	2.5 Ounces
Shipping Weight (approx.)	7.0 Ounces

RADIO FREQUENCY POWER AMPLIFIER OR OSCILLATOR

MAXIMUM RATINGS (Per Tube)	
DC PLATE VOLTAGE	1000 VOLTS MAX.
DC CATHODE CURRENT	0.125 AMP. MAX.
DC GRID VOLTAGE	—150 VOLTS MAX.
DC GRID CURRENT	0.050 AMP. MAX.
INSTANTANEOUS PEAK POSITIVE GRID VOLTAGE	30 VOLTS MAX.
INSTANTANEOUS PEAK NEGATIVE GRID VOLTAGE	—400 VOLTS MAX.
PLATE DISSIPATION	100 WATTS MAX.
GRID DISSIPATION	2 WATTS MAX.

TYPICAL OPERATION (Per Tube)

	Power Amplifier Grounded-Grid (Key-down conditions)		
	500 Mc	2500 Mc	2900 Mc
DC PLATE VOLTAGE	800	900	1000 Volts
DC GRID VOLTAGE (approx.)	—20	—22	—9.5 Volts
DC PLATE CURRENT	80	90	100 Milliamp.
DC GRID CURRENT (approx.)	30	25	15 Milliamp.
DRIVING POWER (approx.)	6	......	.... Watts
USEFUL OUTPUT POWER	27	15	9.5 Watts

PLATE MODULATED RADIO FREQUENCY AMPLIFIER OR OSCILLATOR

MAXIMUM RATINGS (Per Tube)	
DC PLATE VOLTAGE	600 VOLTS MAX.
DC CATHODE CURRENT	0.100 AMP. MAX.
DC GRID VOLTAGE	—150 VOLTS MAX.
DC GRID CURRENT	0.050 AMP. MAX.
INSTANTANEOUS PEAK POSITIVE GRID VOLTAGE	30 VOLTS MAX.
INSTANTANEOUS PEAK NEGATIVE GRID VOLTAGE	—400 VOLTS MAX.
PLATE DISSIPATION	70 WATTS MAX.
GRID DISSIPATION	2 WATTS MAX.

▶ TYPICAL OPERATION (Per Tube)
500 Mc, Grounded-Grid, Carrier Conditions.

DC PLATE VOLTAGE	600 Volts
DC GRID VOLTAGE (approx.)	—15 Volts
DC PLATE CURRENT	65 Milliamp.
DC GRID CURRENT (approx.)	35 Milliamp.
DRIVING POWER (approx.)	5 Watts
USEFUL CARRIER POWER OUTPUT	16 Watts

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▶ Indicates change from sheet dated 6-15-57

APPLICATION

MECHANICAL

Mounting—The 3CX100A5 may be operated in any position. It should be firmly held in place by spring-finger collets bearing on the terminal surfaces. The tube should seat against the under side of the anode-terminal flange which is on the plane of reference for longitudinal dimensions. In applications involving severe shock and vibration, the tube may be clamped in place by applying a suitable clamping device to the anode-terminal flange. It is recommended that no other portion of the tube be subjected to clamping forces.

Connections—The tube terminals are in the form of concentric cylinders of graduated diameters so that the 3CX100A5 may be conveniently used with coaxial tuning devices. Spring-fingered collets should be used to make contact with the anode, grid, cathode and heater terminals. Adequate contact area and spring pressure should be provided to minimize heating and to prevent erratic circuit performance at the higher frequencies. Non-contacting or intermittently-contacting collet fingers will cause troublesome circuit behavior especially at very-high and ultra-high frequencies. Electrode contact surfaces should be kept clean and free of oxide coatings.

Cooling—Sufficient cooling must be provided for the anode and body seals to maintain operating temperatures below the rated maximum values:

Ceramic to Metal Seals	250°C	(300°C short term overload value)
Anode Core	250°C	(300°C short term overload value)

At sea level, with an inlet air temperature of 20°C (68°F), 12.5 cubic feet per minute of air flow is required to cool the anode at 100 watts plate dissipation when the air cowling as illustrated is used. Operation at higher altitudes or with higher inlet temperatures requires increased volumes of flow to obtain equivalent cooling. A source of design information for such conditions is the article "Blower Selection for Forced Air-Cooled Tubes", by A. G. Nekut, Electronics, August 1950. When using the anode cowling as illustrated here, it is necessary to provide additional facilities for seal cooling.

It should be borne in mind that operating temperature is the sole criterion of cooling effectiveness, regardless of the coolant type, flow rate or coolant temperature. One method of measuring the surface temperatures is the use of temperature sensitive lacquer, such as "Tempilaq." This product can be obtained from the Tempil Corp., 132-34 West 22nd Street, New York 11, New York. When temperature sensitive materials are used, extremely thin applications must be used to avoid interference with the transfer of heat from the tube to the air stream, which would cause inaccurate indications.

ELECTRICAL

Heater Operation—The rated heater voltage for the 3CX100A5 is 6.0 volts and the working voltage should be selected from the table below. The heater voltage should be maintained within plus or minus 5% of its intended value to minimize variations in circuit performance and to obtain maximum tube life.

At frequencies above approximately 1000 megacycles, transit time effects begin to influence the cathode temperature. The amount of driving power diverted to heating the cathode by back-bombardment will depend upon the frequency, the plate current and driving power being supplied to the tube. If the conditions of operation result in appreciable cathode back-heating, it may be necessary to start dynamic tube operation at normal heater voltage followed by a reduction of heater voltage to the proper value. The following table is intended as a general guide in this respect.

Mc	E_f (volts)
Up to 1000	6.0
1000 to 2000	5.5
2000 and above	5.0

The heater must not be operated at less than 4.5 volts in any case.

Cathode Operation—The oxide-coated unipotential cathode in the 3CX100A5 must be protected against excessively high emission currents. For all types of operation the maximum rated dc current is 125 milliamperes. The cathode and one side of the heater are connected together internally.

It is recommended that rated heater voltage be applied for a minimum of 30 seconds before other operating voltages are applied. Tube performance will become stabilized 60 seconds after the heater voltage is applied.

Control Grid Operation—Grid dissipation must not exceed the rated maximum 2.0 watts grid dissipation power.

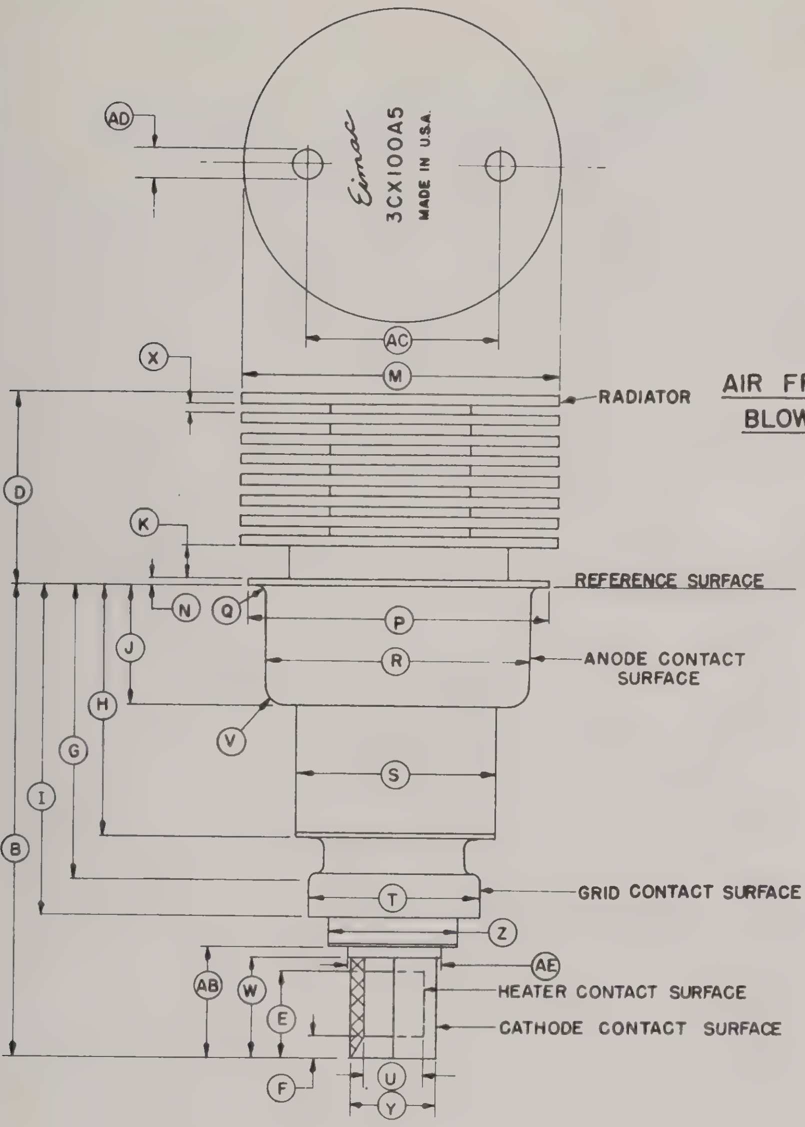
At operating frequencies near 500 megacycles, the driving power necessary for maximum output is in the order of 6 watts and as the operating frequency is increased the driving power requirements increase. Most of this increased driving power is absorbed in circuit losses other than grid dissipation, however, so that the grid dissipation will increase very little.

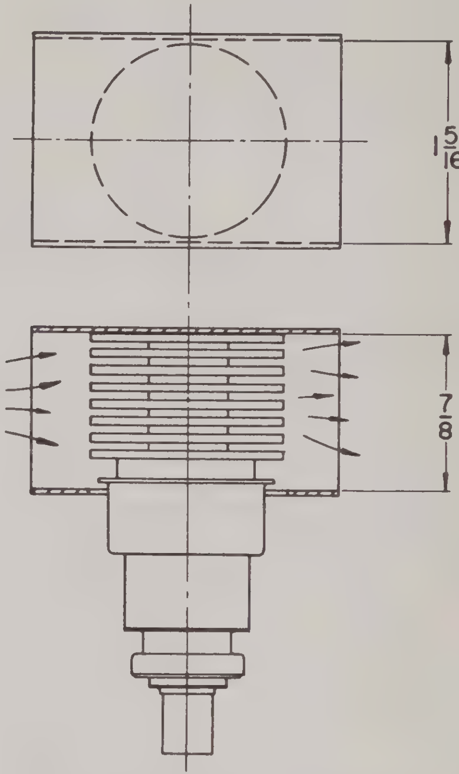
The maximum rated dc grid voltage is —150 volts and the grid may be driven to a maximum of 30 peak volts positive or to —400 peak volts negative.

The grid bias required by various 3CX100A5 tubes may vary between limits approximately 50% above and below the center value, and means should be provided in the equipment to accommodate such variation.

Plate Operation—The maximum rated plate dissipation power is 100 watts. In plate modulated applications, the carrier plate dissipation power must be limited to 70 watts to avoid exceeding the plate dissipation rating with 100% sine wave modulation.

Special Applications—If it is desired to operate this tube under conditions widely different from those given here, write to Eitel-McCullough, Inc., San Bruno, California for information and recommendations.



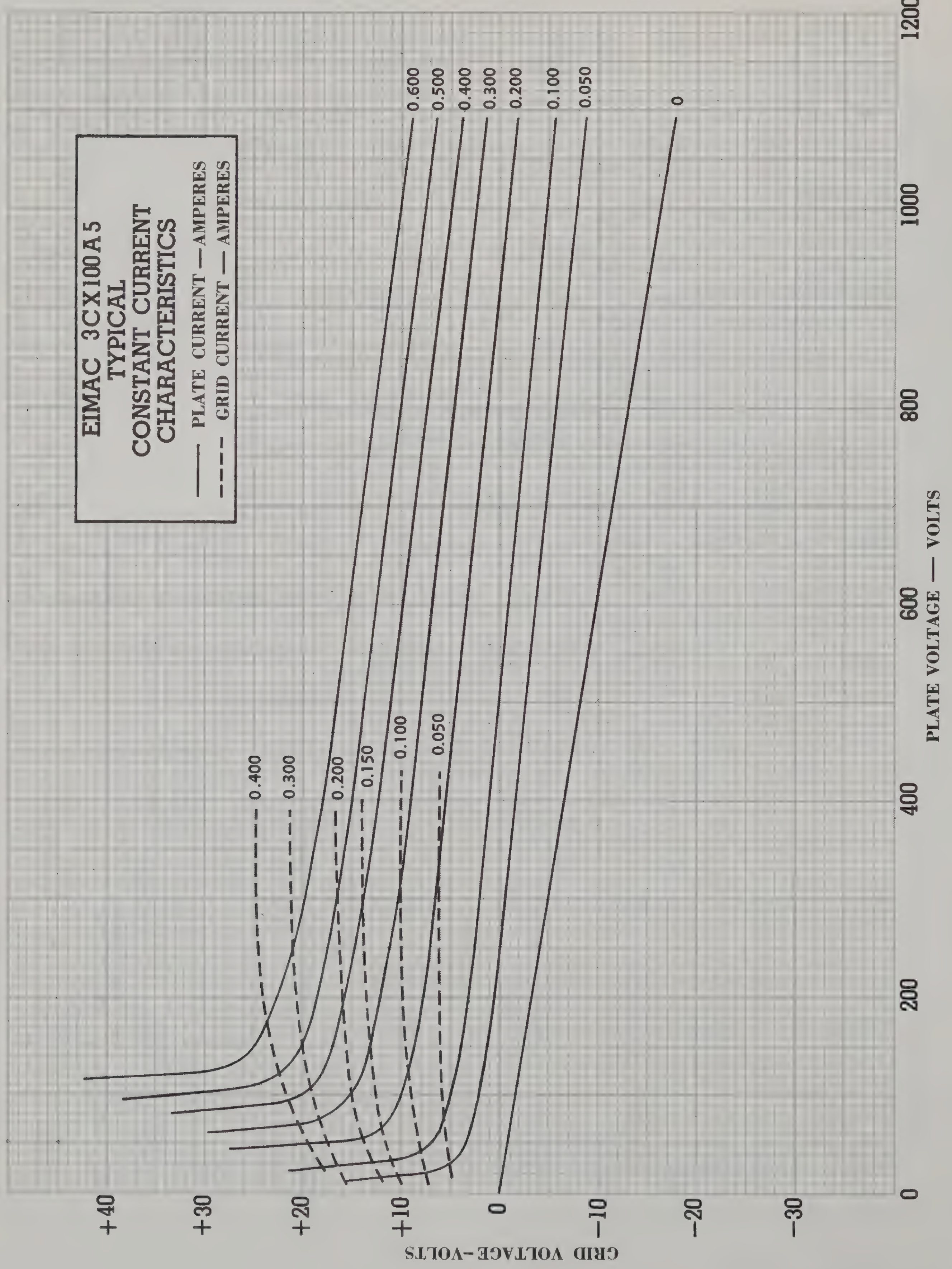


RECOMMENDED COWLING
FOR
FORCED-AIR COOLING
OF ANODE

REF.	NOM.	MIN.	MAX.
B		1.815	1.875
D		.766	.826
E		.341	.401
F		.026	.086
G		1.095	1.135
H		.880	.920
I		1.289	1.329
J		.462	.477
K		.125	.185
M		1.234	1.264
N	.031		
P		1.180	1.195
Q	.031		
R		1.024	1.039
S		.752	.792
T		.653	.668
U		.213	.223
V	.094		
W		.400	.460
X		.016	.046
Y		.313	.328
Z		.455	.470
AB		.420	.480
AC	.750		
AD	.125		
AE		.333	.348

NOTES:

1. The total indicated runout of the anode contact surface and the grid contact surface with respect to the cathode contact surface shall not exceed .020.
2. The total indicated runout of the cathode contact surface with respect to the heater contact surface shall not exceed .012.


EIMAC 3CX100A5
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
PLATE CURRENT — AMPERES
GRID CURRENT — AMPERES
0.600
0.500
0.400
0.300
0.200
0.100
0.050
0
0.400
0.300
0.200
0.150
0.100
0.050
PLATE VOLTAGE — VOLTS
0
200
400
600
800
1000
1200
GRID VOLTAGE-VOLTS
+40
+30
+20
+10
0
−10
−20
−30

Eimac®

EITEL-McCULLOUGH, INC.
SAN CARLOS · CALIFORNIA

TENTATIVE DATA

3CX10,000A3

MEDIUM-MU POWER TRIODE

The Eimac 3CX10,000A3 is a ceramic and metal power triode intended primarily for use as a power oscillator in industrial-heating applications. It is also useful as a grounded-grid FM amplifier, as a conventional plate-modulated amplifier at broadcast frequencies, or as a linear amplifier.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated-Tungsten	
Voltage	7.5 volts
Current	100 amperes
Amplification Factor	20
Interelectrode Capacitances:	
Grid-Filament	60 uuf
Grid-Plate	40 uuf
Plate-Filament	2.0 uuf
Frequency for Maximum Ratings	110 Mc

MECHANICAL

Base	Coaxial
Recommended Socket	Eimac SK-1300
Operating Position	Vertical, base up or down
Cooling	Forced air
Maximum Operating Temperatures:	
Anode Core	250°C
Ceramic-to-Metal Seals	250°C
Maximum Dimensions:	
Height	8.5 inches
Diameter	7.0 inches
Net Weight	12 pounds

R-F INDUSTRIAL OSCILLATOR
CLASS-C

MAXIMUM RATINGS

D-C PLATE VOLTAGE	7000 MAX.	VOLTS
D-C PLATE CURRENT	4.0 MAX.	AMPS
PLATE DISSIPATION	10 MAX.	KW
GRID DISSIPATION	250 MAX.	WATTS

TYPICAL OPERATION

D-C Plate Voltage	6000	7000 volts
D-C Grid Voltage	-575	-670 volts
D-C Plate Current	4.0	4.0 amps
D-C Grid Current	610	670 ma
Plate Input Power	24	28 kw
Plate Output Power	18.9	22.4 kw

R-F POWER AMPLIFIER
GROUNDED-GRID, CLASS-C

MAXIMUM RATINGS

D-C PLATE VOLTAGE	7000 MAX.	VOLTS
D-C PLATE CURRENT	4.0 MAX.	AMPS
PLATE DISSIPATION	10 MAX.	KW
GRID DISSIPATION	250 MAX.	WATTS

TYPICAL OPERATION

D-C Plate Voltage	6000	7000 volts
D-C Grid Voltage	-535	-625 volts
D-C Plate Current	4.0	4.0 amps
D-C Grid Current	545	530 ma
Driving Power	3700	4100 watts
Plate Output Power	20.5	24.5 kw

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R-F POWER AMPLIFIER
PLATE-MODULATED, CLASS-C

MAXIMUM RATINGS

D-C PLATE VOLTAGE	5500 MAX.	VOLTS
D-C PLATE CURRENT	3.0 MAX.	AMPS
PLATE DISSIPATION	6.5 MAX.	KW
GRID DISSIPATION	250 MAX.	WATTS

TYPICAL OPERATION

D-C Plate Voltage	4000	5000	volts
D-C Grid Voltage	-480	-600	volts
D-C Plate Current	3.0	3.0	amps
D-C Grid Current	660	550	ma
Driving Power	530	515	watts
Plate Output Power	9.7	12.4	kw

R-F LINEAR AMPLIFIER
GROUNDED-GRID, CLASS-AB2

MAXIMUM RATINGS

D-C PLATE VOLTAGE	7000 MAX.	VOLTS
D-C PLATE CURRENT	4.0 MAX.	AMPS
PLATE DISSIPATION	10 MAX.	KW
GRID DISSIPATION	250 MAX.	WATTS

TYPICAL OPERATION

D-C Plate Voltage	6000	7000	volts
Zero-Sig Grid Voltage*	-270	-325	volts
Max-Sig D-C Plate Current	4.0	4.0	amps
Max-Sig D-C Grid Current	300	250	ma
Driving Power	1900	2050	watts
Plate Output Power	18	20	kw

*Adjust to give 500 milliamperes zero-signal d-c plate current.

APPLICATION

▶ Cooling - The maximum temperature rating for the external surfaces of the 3CX10,000A3 is 250°C. Sufficient forced-air cooling must be provided to keep the temperature of the anode core and the temperature of the ceramic-metal seals below 250°C. Tube life is usually prolonged if these areas are maintained at temperatures below this maximum rating. Minimum air-flow requirements to maintain anode-core and seal temperatures below 225°C with an inlet-air temperature of 50°C are tabulated below.

	Sea Level		10,000 Feet	
Plate** Dissipation (Watts)	Air Flow (CFM)	Pressure Drop (Inches of Water)	Air Flow (CFM)	Pressure Drop (Inches of Water)
▶ 4000	70	0.15	102	0.22
6000	152	0.36	220	0.52
8000	270	0.92	392	1.34
10,000	423	1.93	615	2.80

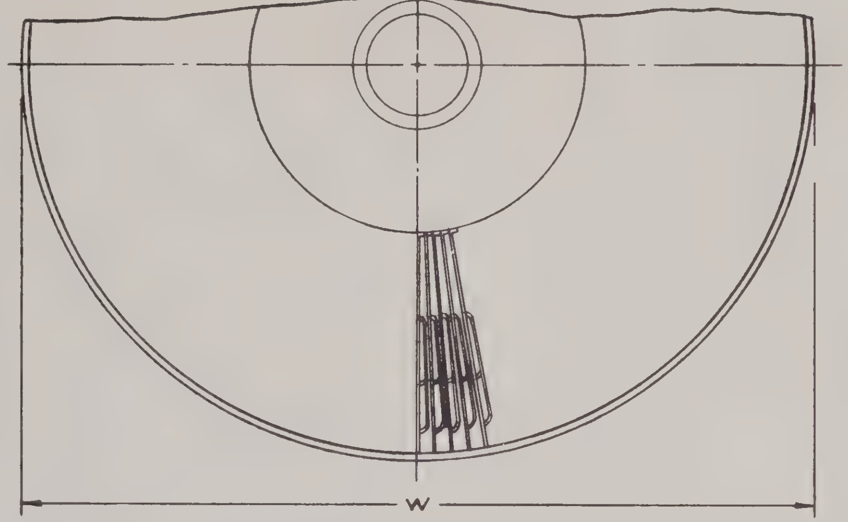
**Since the power dissipated by the filament is about 750 watts and since grid dissipation can, under some circumstances, represent another 250 watts, allowance has been made in preparing this tabulation for an additional 1000 watts dissipation.

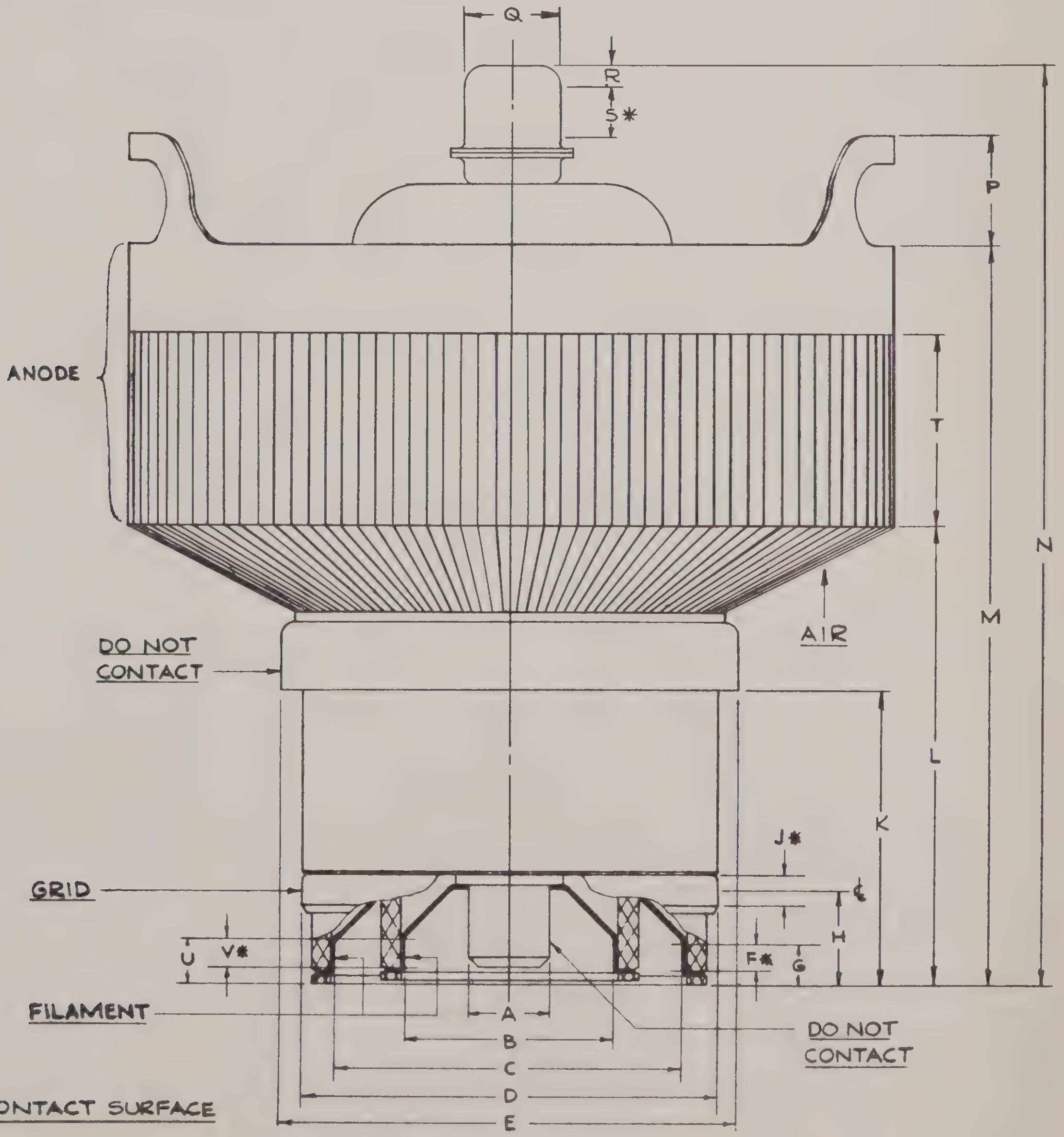
Filament Operation - The rated filament voltage for the 3CX10,000A3 is 7.5 volts. Filament voltage, as measured at the socket, should be maintained at this value to obtain maximum tube life. In no case should it be allowed to deviate from the rated value by more than five percent.

Special Applications - If it is desired to operate this tube under conditions widely different from those given here, write to the Application Engineering Department, Eitel-McCullough, Inc., 301 Industrial Way, San Carlos, California, for information and recommendations.

▶ Indicates change from sheet dated 8-15-60)

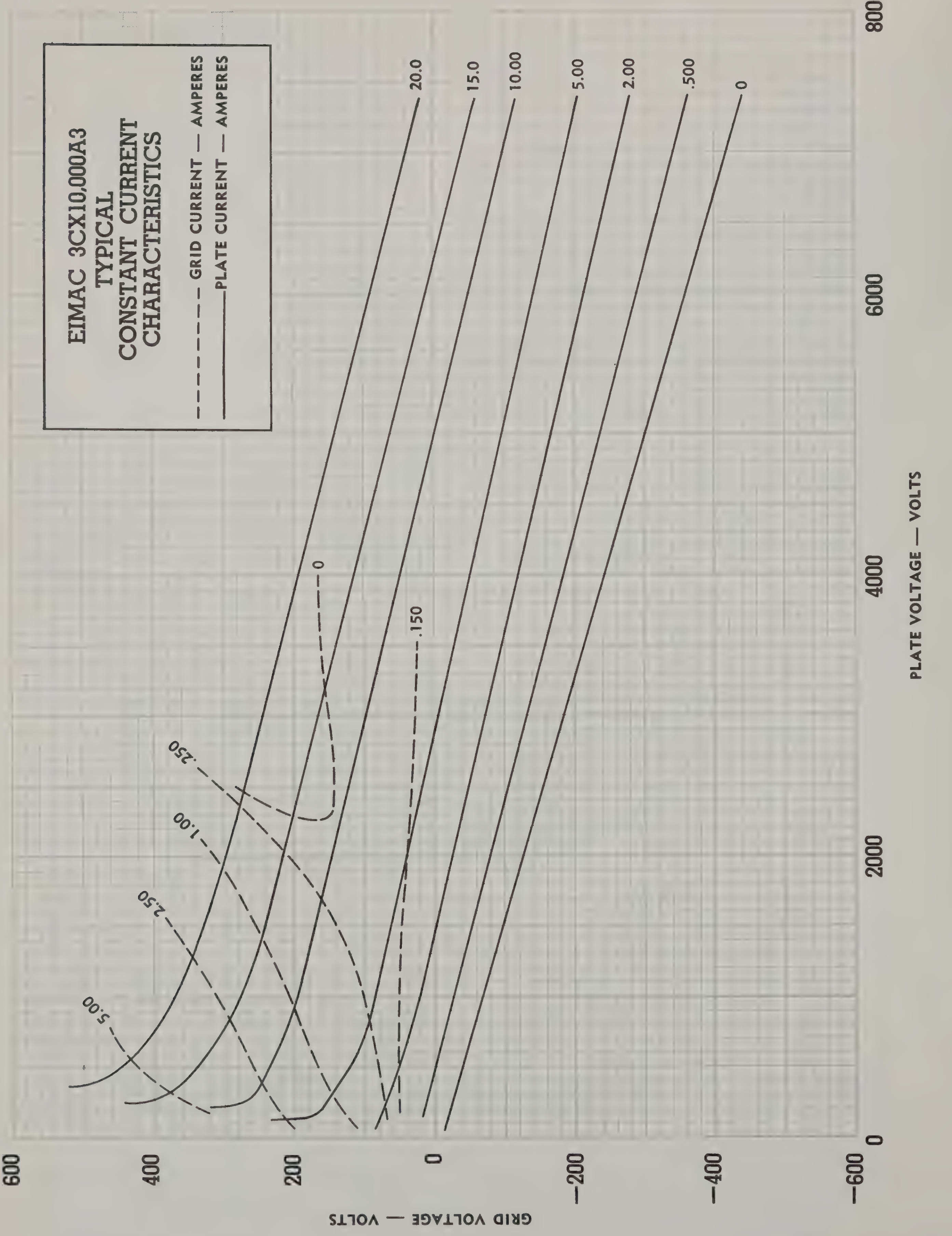
DIM	NOM.	MIN.	MAX.
A	.740		
B	1.916		
C	3.153		
D	3.803		
E	4.185		
F	1/4		
G	.384		
H	.864		
J	1/4		
K	2.706		
L	4 3/16		
M	6 [illegible]/64		
N	8 1/2		
P	1		
Q	.875		
R	3/16		
S	1/2		
T	1 13/16		
U	.394		
V	1/4		
W	6.995		





NOTE:

1. * DENOTES CONTACT SURFACE


EIMAC 3CX10,000A3
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
GRID CURRENT — AMPERES
PLATE CURRENT — AMPERES
20.0
15.0
10.00
5.00
2.00
.500
0
0
.150
.250
1.00
2.50
5.00
PLATE VOLTAGE — VOLTS
0
2000
4000
6000
8000
GRID VOLTAGE — VOLTS
600
400
200
0
−200
−400
−600

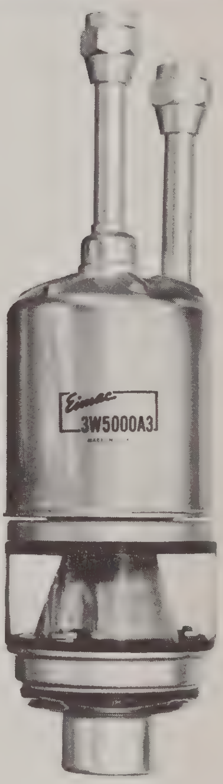
Eimac®

EITEL-McCULLOUGH, INC.
SAN CARLOS · CALIFORNIA

3W5000A3

MEDIUM MU TRIODE

▶



The Eimac 3W5000A3 is a water-cooled, medium-mu transmitting triode with a maximum plate dissipation rating of 5000 watts. Relatively high power-output as an oscillator, amplifier or modulator may be obtained from this tube at low plate voltages. A single tube will deliver a radio frequency output of 7500 watts at 4000 volts at frequencies up to 110 Mc.

The tube has a rugged, low-inductance cylindrical filament-stem structure, which readily becomes a part of a linear filament-tank circuit for VHF operation. The grid provides thorough shielding between the input and output circuits for grounded-grid applications and is conveniently terminated in a ring between the plate and filament terminals.

NOTE: THE 3W5000A3 IS A WATER-COOLED VERSION OF THE AIR-COOLED 3X2500A3.

The plate dissipation of the 3W5000A3 is 5000 watts. Other ratings are the same as for the 3X2500A3 tube type.

The 3W5000A3 should be used where water cooling is preferred and for industial applications or installations where reserve anode dissipation is desired.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated tungsten	
Voltage	7.5 volts
Current	51 amperes
Amplification Factor (Average)	20
Direct Interelectrode Capacitances (Average)	
Grid-Plate	20 μμf
Grid-Filament	36 μμf
Plate-Filament	1.2 μμf
Transconductance (i_b=830 ma., E_b=3000v.)	20,000 umhos
Frequency for Maximum Ratings	75 Mc.

MECHANICAL

Base	see drawing
Mounting	Vertical, base down or up
Maximum Overall Dimensions:	
Length	12.56 inches
Diameter	3.63 inches
Net Weight	3.5 pounds
Shipping Weight (Average)	15 pounds
Cooling	Water and Forced Air

The water-cooled anode requires one gallon of cooling water per minute for the rated plate dissipation of 5 kilowatts. The outlet water temperature must not exceed a maximum of 70°C. under any conditions. The inlet water pressure must not exceed a maximum of 60 pounds per square inch. The pressure drop across the anode is negligible compared to the drop in the associated piping.

The grid-terminal contact surface and adjacent glass must be cooled by forced air. The quantity, velocity and direction must be adjusted to limit the maximum seal temperature to 150°C.

The filament stem structure also requires forced-air cooling. A minimum of 6 cubic feet per minute must be directed into the space between the inner and outer filament contacting surfaces.

Air and water flow must be started before filament power is applied and maintained for at least five minutes after the filament power has been removed.

RADIO FREQUENCY POWER AMPLIFIER OR OSCILLATOR

(Conventional Neutralized Amplifier—Frequencies below 75 Mc.)

Class-C FM or Telegraphy (Key-down conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	6000 MAX. VOLTS
D-C PLATE CURRENT	2.5 MAX. AMPS
PLATE DISSIPATION	5000 MAX. WATTS
GRID DISSIPATION*	150 MAX. WATTS

TYPICAL OPERATION (Frequencies below 75 Mc., per tube)

D-C Plate Voltage	4000	5000	6000	Volts
D-C Plate Current	2.5	2.5	2.08	Amps
D-C Grid Voltage	—300	—450	—500	Volts
D-C Grid Current	245	265	180	Ma.
Peak R-F Grid Input Voltage	580	750	765	Volts
Driving Power (approx.)	142	197	136	Watts
Grid Dissipation	68	78	46	Watts
Plate Power Input	10,000	12,500	12,500	Watts
Plate Dissipation	2500	2500	2500	Watts
Plate Power Output	7500	10,000	10,000	Watts

*See application notes.

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▶ Indicates change from sheet dated 8-23-53

RADIO FREQUENCY POWER AMPLIFIER

Grounded-Grid Circuit
Class-C FM Telephony

MAXIMUM RATINGS (Frequencies between 85 and 110 Mc.)

D-C PLATE VOLTAGE	4000	MAX. VOLTS
D-C PLATE CURRENT	2.0	MAX. AMPS
D-C GRID CURRENT*	200	MAX. MA.
PLATE DISSIPATION	5000	MAX. WATTS
GRID DISSIPATION*	150	MAX. WATTS

*See application notes.

TYPICAL OPERATION (110 Mc., per tube)

D-C Plate Voltage	3700	4000	Volts
D-C Grid Voltage	—450	—500	Volts
D-C Plate Current	1.8	1.85	Amps
D-C Grid Current	190	190	Ma.
Driving Power (approx.)	1600	1900	Watts
Useful Power Output	6850	7500	Watts

PLATE MODULATED RADIO FREQUENCY AMPLIFIER

(Conventional Neutralized Amplifier—Frequencies below 75 Mc.)
Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	5000	MAX. VOLTS
D-C PLATE CURRENT	2.0	MAX. AMPS
PLATE DISSIPATION	3350	MAX. WATTS
GRID DISSIPATION	150	MAX. WATTS

TYPICAL OPERATIONS (Frequencies below 75 Mc., per tube)

D-C Plate Voltage	4000	4500	5000	Volts
D-C Plate Current	1.67	1.55	1.45	Amps
Total Bias Voltage	—450	—500	—550	Volts
Fixed Bias Voltage	—230	—325	—410	Volts
Grid Resistor	1500	1500	1400	Ohms
D-C Grid Current	150	120	100	Ma.
Peak R-F Grid Input Voltage	680	720	760	Volts
Driving Power (approx.)	102	86	76	Watts
Grid Dissipation	35	26	21	Watts
Plate Power Input	6670	6970	7250	Watts
Plate Dissipation	1670	1670	1670	Watts
Plate Power Output	5000	5300	5580	Watts

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class B (Sinusoidal wave, two tubes unless otherwise specified)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	6000	MAX. VOLTS
MAX.-SIGNAL D-C PLATE CURRENT, PER TUBE	2.5	MAX. AMPS
PLATE DISSIPATION, PER TUBE	5000	MAX. WATTS

TYPICAL OPERATION CLASS AB_2 (Two tubes)

D-C Plate Voltage	4000	5000	6000	Volts
D-C Grid Voltage (approx.)*	—150	—190	—240	Volts
Zero-Signal D-C Plate Current	0.6	0.5	0.4	Amps
Max-Signal D-C Plate Current	4.0	3.2	3.0	Amps
Effective Load, Plate to Plate	2200	3600	4650	Ohms
Peak A-F Grid Input Voltage (per tube)	340	360	390	Volts
Max.-Signal Peak Driving Power	340	230	225	Watts
Max.-Signal Nominal Driving Power (approx.)	170	115	113	Watts
Max.-Signal Plate Power Output	11,000	11,000	13,000	Watts

*Adjust to give stated zero-signal plate current.

TYPICAL OPERATION CLASS AB_2 (Two tubes)

(Modulator service for 4000 and 5000 volt operation, to modulate one or two tubes, as shown under "Plate Modulated Radio Frequency Amplifier.")

D-C Plate Voltage	4000	5000	4000	5000	Volts
D-C Grid Voltage (approx.)*	—155	—200	—145	—190	Volts
Zero-Signal D-C Plate Current	0.4	0.4	0.6	0.5	Amps
Max.-Signal D-C Plate Current	1.35	1.13	2.70	2.26	Amps
Effective Load, Plate to Plate	6600	10,000	3300	5000	Ohms
Peak A-F Grid Input Voltage (per tube)	240	275	285	310	Volts
Max.-Signal Peak Driving Power	42	40	134	118	Watts
Max.-Signal Nominal Driving Power (approx.)	21	20	67	59	Watts
Max.-Signal Plate Power Output	3700	4000	7400	8000	Watts
Will Modulate R. F. Final Input of	6670	7250	13,340	14,500	Watts

*Adjust to give stated zero-signal plate current.

APPLICATION

Filament Voltage—The filament voltage, as measured directly at the tube, should be 7.5 volts with maximum allowable variations due to line fluctuation of from 7.1 to 7.9 volts.

Bias Voltage—There is little advantage in using bias voltages in excess of those given under "Typical Operation", except in certain very specialized applications. Where bias is obtained from a grid resistor, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation.

Plate Voltage—The plate supply voltage for the 3W5000A3 should not exceed 6000 volts. In most cases there is little advantage in using plate-supply voltages higher than those given under "Typical Operation" for the power output desired.

In Class-C FM or Telegraphy service, a 0.1 henry choke, shunted by a spark gap, should be series connected between the plates of the amplifier tubes and the high voltage plate supply capacitor to offer protection from transients and surges. In plate modulated service, where a plate modulation transformer is used, the protective choke is not normally required.

Grid Dissipation—The power dissipated by the grid of the 3W5000A3 must never exceed 150 watts. Grid dissipation may be calculated from the following expression:

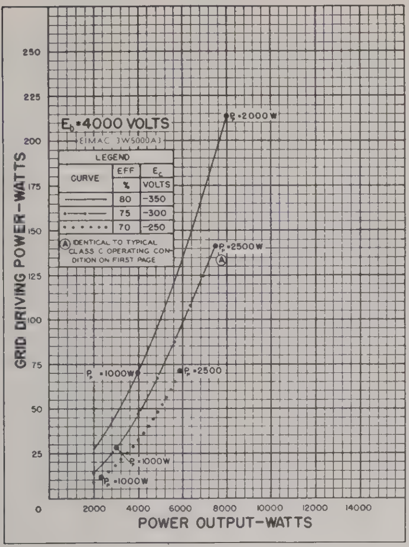
$$P_g = e_{cmp}\, I_c$$

where P_g = Grid dissipation,
e_{cmp} = Peak positive grid voltage, and
I_c = D-C grid current

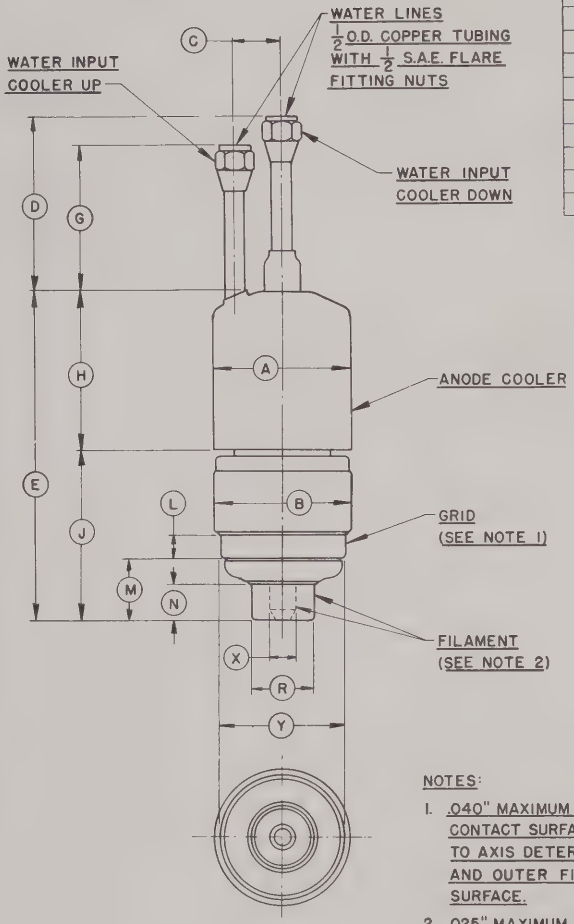
e_{cmp} may be measured by means of a suitable peak voltmeter connected between filament and grid. Any suitable peak v.t.v.m. circuit may be used (one is shown in "Vacuum Tube Ratings", Eimac News, January 1945. This article is available, in reprint form on request).

In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading.

In VHF operation, particularly above 75 Mc., the d-c grid current must not exceed 200 ma. under any conditions of plate loading. With lightly loaded conditions the grid driving-power should be reduced so that the grid current does not exceed one-tenth of the plate curent.

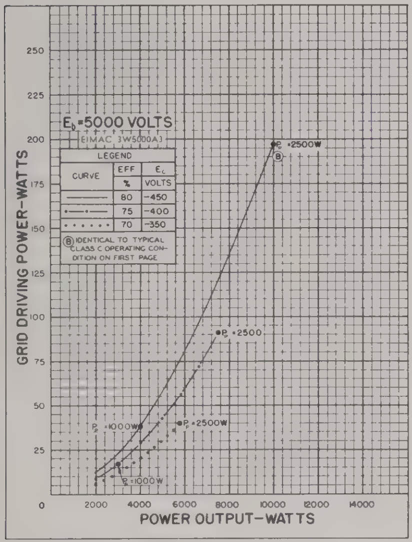


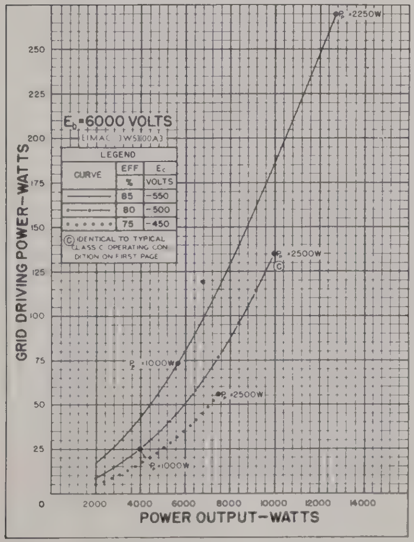
DIMENSION DATA			
REF.	NOM.	MIN.	MAX.
A		3.234	3.266
B			3.625
C		1.062	1.187
D		4.000	4.500
E		7.562	8.062
G		3.250	3.750
H		3.625	3.875
J		3.937	4.187
L		.375	.437
M		1.437	1.562
N		.812	.937
R		1.490	1.510
X		.615	.635
Y		2.990	3.010



NOTES:

1. .040" MAXIMUM RUNOUT OF GRID CONTACT SURFACE WITH RESPECT TO AXIS DETERMINED BY ANODE AND OUTER FILAMENT CONTACT SURFACE.
2. .025" MAXIMUM RUNOUT OF INNER FILAMENT CONTACT SURFACE WITH RESPECT TO OUTER FILAMENT CONTACT SURFACE.
3. DIMENSIONS IN INCHES.

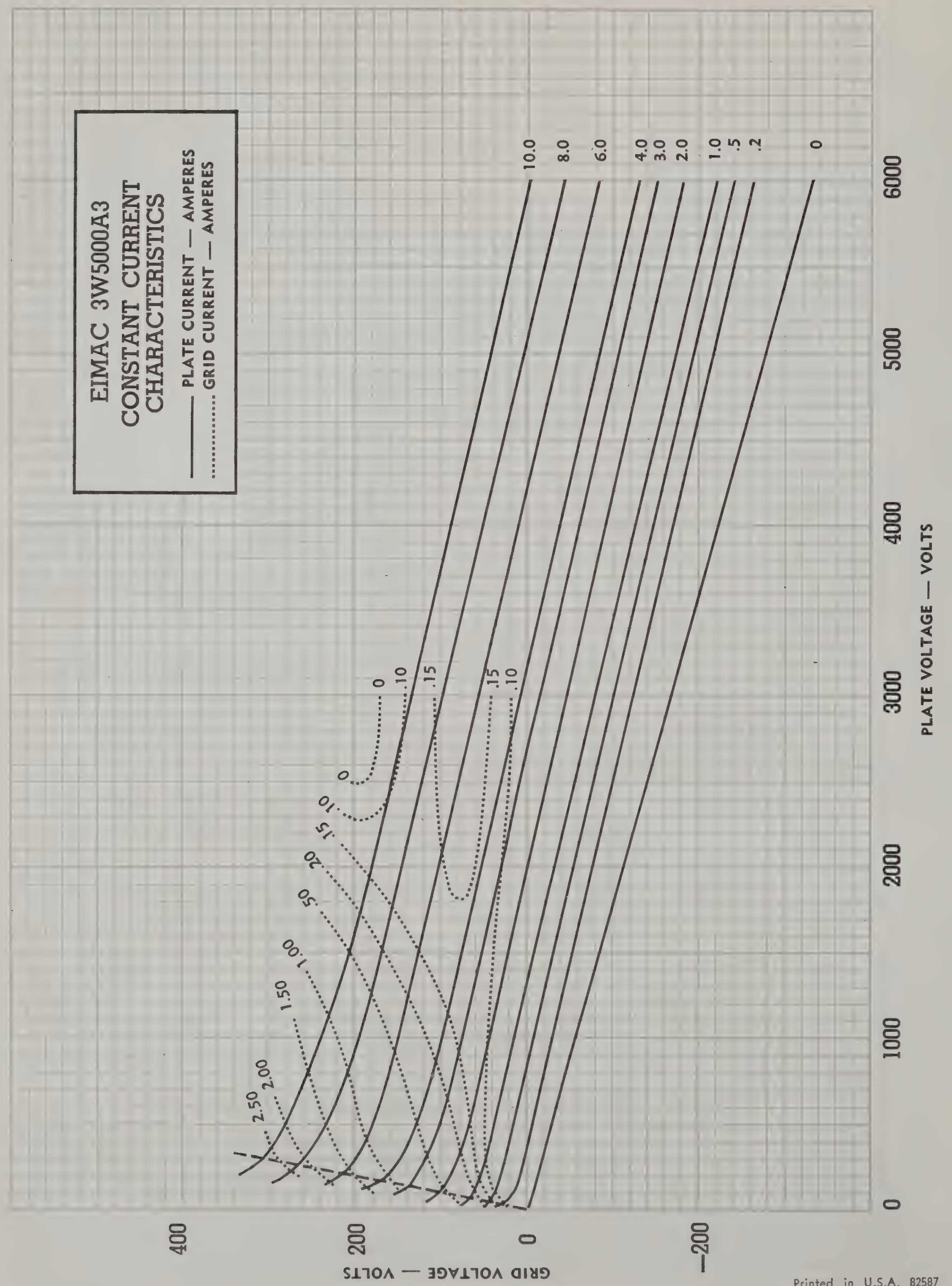




DRIVING POWER vs. POWER OUTPUT

The three charts on this page show the relationship of plate efficiency, power output and approximate grid driving power at plate voltages of 4000, 5000 and 6000 volts. These charts show combined grid and bias losses only. The driving-power and power-output figures do not include circuit losses. The plate dissipation in watts is indicated by Pp. Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 4000, 5000 and 6000 volts respectively.

▶ Indicates change from sheet dated 8-23-53



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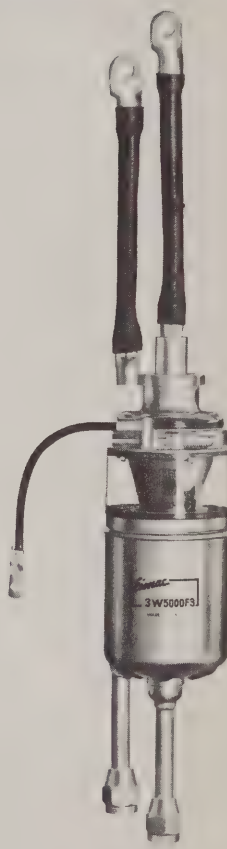
EITEL-McCULLOUGH, INC.
SAN CARLOS · CALIFORNIA

3W5000F3

MEDIUM MU-TRIODE



The Eimac 3W5000F3 is a water-cooled, medium-mu power triode intended for amplifier, oscillator or modulator service. It has a maximum plate dissipation rating of 5000 watts and is capable of high output at relatively low plate voltages. A single 3W5000F3 will deliver a radio frequency plate power-output of 7500 watts at a plate voltage of 4000 volts.

The tube is equipped with flexible filament and grid leads which simplifies socketing and equipment design for industrial and communication frequencies below 30 Mc.

NOTE: The 3W5000F3 is a water-cooled version of the air-cooled 3X2500F3.

The 3W5000F3 should be used where water cooling is preferred and for industrial applications or installations where reserve anode dissipation is desired.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated tungsten		
Voltage	7.5	volts
Current	51	amperes
Maximum allowable starting current	100	amperes
Amplification Factor (Average)	20	
Direct Interelectrode Capacitances (Average)		
Grid-Plate	21	uuf
Grid-Filament	36	uuf
Plate-Filament	1.2	uuf
Transconductance ($I_b = 830$ ma, $E_b = 3000$v)	20,000	umhos
Frequency for Maximum Ratings	30	mc

MECHANICAL

Base	see drawing	
Mounting	vertical, base down or up	
Maximum Over-All Dimensions:		
Length (Does not include filament connectors)	12.56	inches
Diameter	3.63	inches
Net Weight	4.8	pounds
Shipping Weight (Average)	15	pounds
Cooling	Water and forced air	

RADIO FREQUENCY POWER AMPLIFIER OR OSCILLATOR

(Frequencies below 30 Mc.)
Class-C FM or Telegraphy
(Key-down conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	6000	MAX. VOLTS
D-C PLATE CURRENT	2.5	MAX. AMPS
PLATE DISSIPATION	5000	MAX. WATTS
GRID DISSIPATION	150	MAX. WATTS

TYPICAL OPERATION
(Frequencies below 30 Mc., per tube)

D C Plate Voltage	4000	5000	6000	volts
D-C Plate Current	2.5	2.5	2.08	amps
D-C Grid Voltage	—300	—450	—500	volts
D-C Grid Current	245	265	180	ma
Peak R-F Grid Input Voltage	580	750	765	volts
Driving Power (approx.)	142	197	136	watts
Grid Dissipation	68	78	46	watts
Plate Power Input	10,000	12,500	12,500	watts
Plate Dissipation	2500	2500	2500	watts
Plate Power Output	7500	10,000	10,000	watts

PLATE MODULATED RADIO FREQUENCY AMPLIFIER

(Frequencies below 30 Mc.)
Class-C Telephony
(Carrier conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	5000	MAX. VOLTS
D-C PLATE CURRENT	2.0	MAX. AMPS
PLATE DISSIPATION	3350	MAX. WATTS
GRID DISSIPATION	150	MAX. WATTS

TYPICAL OPERATION
(Frequencies below 30 Mc., per tube)

D C Plate Voltage	4000	4500	5000	volts
D-C Plate Current	1.67	1.55	1.45	amps
Total Bias Voltage	—450	—500	—550	volts
Fixed Bias Voltage	—230	—325	—410	volts
Grid Resistor	1500	1500	1400	ohms
D-C Grid Current	150	120	100	ma
Peak R-F Grid Input Voltage	680	720	760	volts
Driving Power (approx.)	102	86	76	watts
Grid Dissipation	35	26	21	watts
Plate Power Input	6670	6970	7250	watts
Plate Dissipation	1670	1670	1670	watts
Plate Power Output	5000	5300	5580	watts

(Effective 10-21-59) Copyright 1959 by Eitel-McCullough, Inc.

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class B (Sinusoidal wave, two tubes unless otherwise specified)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	6000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT, PER TUBE	2.5 MAX. AMPS
PLATE DISSIPATION, PER TUBE	5000 MAX. WATTS

TYPICAL OPERATION (Sinusoidal wave, two tubes unless noted)

D-C Plate Voltage	4000	5000	6000	volts
D-C Grid Voltage[1]	—150	—190	—240	volts
Zero-Signal D-C Plate Current	0.6	0.5	0.4	amps
Max-Signal D-C Plate Current	4.0	3.2	3.0	amps
Effective Load, Plate to Plate	2200	3600	4650	ohms
Peak A-F Grid Input Voltage (per tube)*	340	360	390	volts
Max-Signal Peak Driving Power*	340	230	225	watts
Max-Signal Nominal Driving Power*	170	115	113	watts
Max-Signal Plate Output Power	11,000	11,000	13,000	watts

*Approximate values.

[1]Adjust to give listed zero-signal plate current.

TYPICAL OPERATION CLASS AB_2 (Two Tubes)

Modulator service for 4000 and 5000 volt operation, to modulate one or two tubes, as shown under "Plate Modulated Radio Frequency Amplifier" (Page 1)

D-C Plate Voltage	4000	5000	4000	5000	volts
D-C Grid Voltage (approx.)*	—155	—200	—145	—190	volts
Zero-Signal D-C Plate Current	0.4	0.4	0.6	0.5	amps
Max-Signal D-C Plate Current	1.35	1.13	2.70	2.26	amps
Effective Load, Plate to Plate	6600	10,000	3300	5000	ohms
Peak A-F Grid Input Voltage (per tube)	240	275	285	310	volts
Max-Signal Peak Driving Power	42	40	134	118	watts
Max-Signal Nominal Driving Power (approx.)	21	20	67	59	watts
Max-Signal Plate Power Output	3700	4000	7400	8000	watts
Will Modulate one Tube R-F Final Input of	6670	7250			watts
Will Modulate two tubes R-F Final Input of			13,340	14,500	watts

*Adjust to give stated zero-signal plate current.

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER "TYPICAL OPERATION," POSSIBLY EXCEEDING THE MAXIMUM RATINGS GIVEN FOR CW SERVICE, WRITE EITEL-McCULLOUGH, INC., FOR INFORMATON AND RECOMMENDATIONS

APPLICATION

Cooling—The water-cooled anode requires one gallon of cooling water per minute for the rated plate dissipation of 5 kilowatts. The outlet water temperature must not exceed a maximum of 70° C under any conditions. The inlet water pressure must not exceed a maximum of 60 pounds per square inch. The pressure drop across the anode is negligible compared to the drop in the associated piping.

The grid-terminal contact surface and adjacent glass must be cooled by forced air. The quantity, velocity and direction must be adjusted to limit the maximum seal temperature to 150° C.

The filament stem structure also requires forced-air cooling. A minimum of 6 cubic feet per minute must be directed into the space between the inner and outer filament contacting surfaces.

Air and water flow must be started before filament power is applied and maintained for at least five minutes after the filament power has been removed.

Filament Voltage—The filament voltage, as measured directly at the tube, should be 7.5 volts with maximum allowable variations due to line fluctuation of from 7.12 to 7.87 volts.

Bias Voltage—There is little advantage in using bias voltages in excess of those given under "Typical Operation," except in certain very specialized applications. Where bias is obtained from a grid resistor, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation.

Plate Voltage—The plate supply voltage for the 3W5000F3 should not exceed 6000 volts. In most cases there is little advantage in using plate-supply voltages higher than those given under "Typical Operation" for the power output desired.

In Class-C FM or Telegraphy service, a 0.1 henry choke, shunted by a spark gap, should be series connected between the plates of the amplifier tubes and the high voltage plate supply capacitor to offer protection from transients and surges. In plate modulated service, where a plate modulation transformer is used, the protective choke is not normally required.

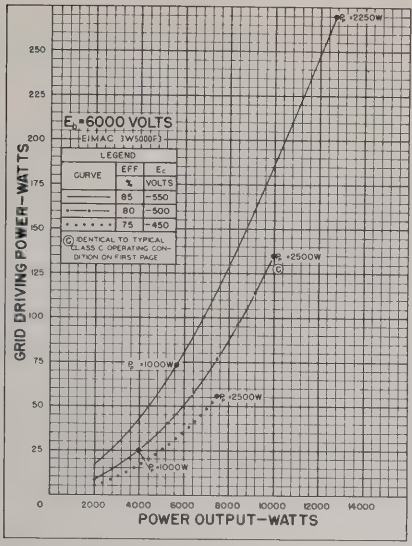
Grid Dissipation—The power dissipated by the grid of the 3W5000F3 must never exceed 150 watts. Grid dissipation may be calculated from the following expression

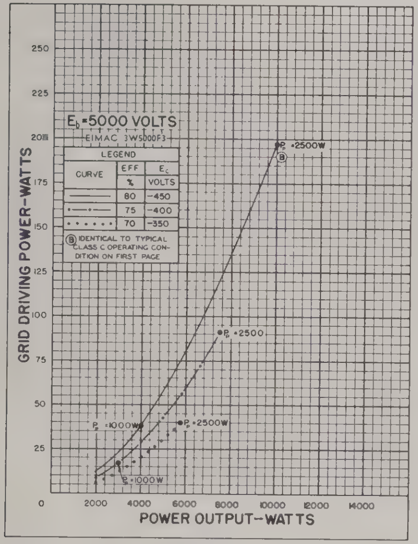
$$P_g=e_{cmp}I_c$$

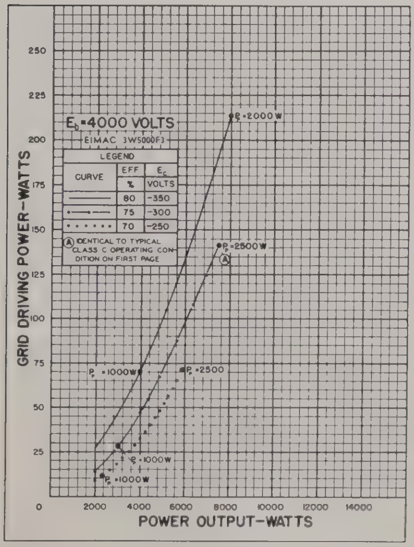
where P_g=Grid dissipation,
e_{cmp}=Peak positive grid voltage, and
I_c=D-C grid current

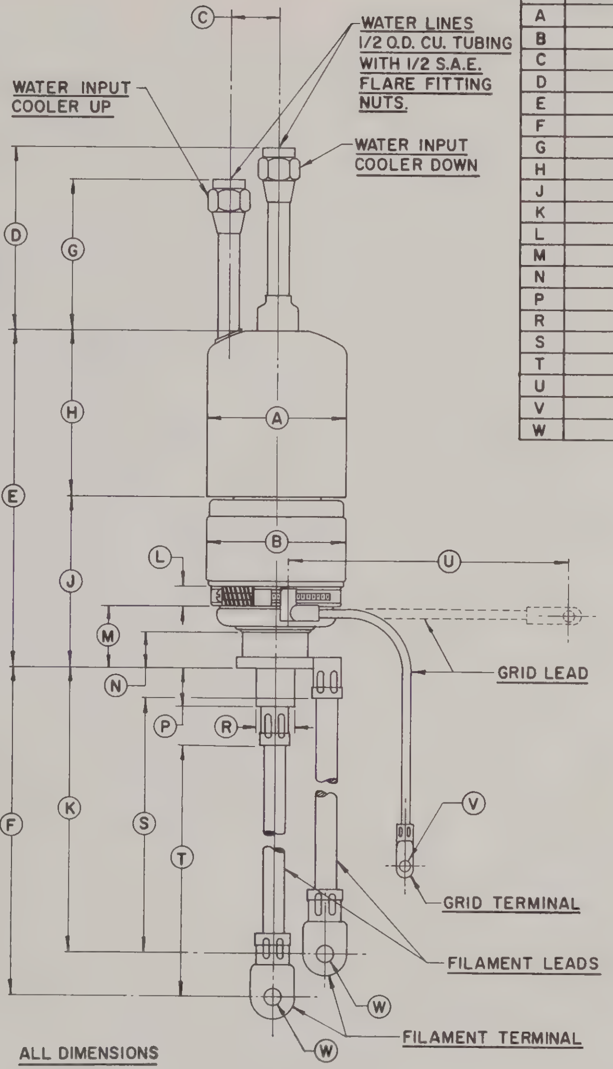
e_{cmp} may be measured by means of a suitable peak voltmeter connected between filament and grid. Any suitable peak v.t.v.m. circuit may be used.

In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading.









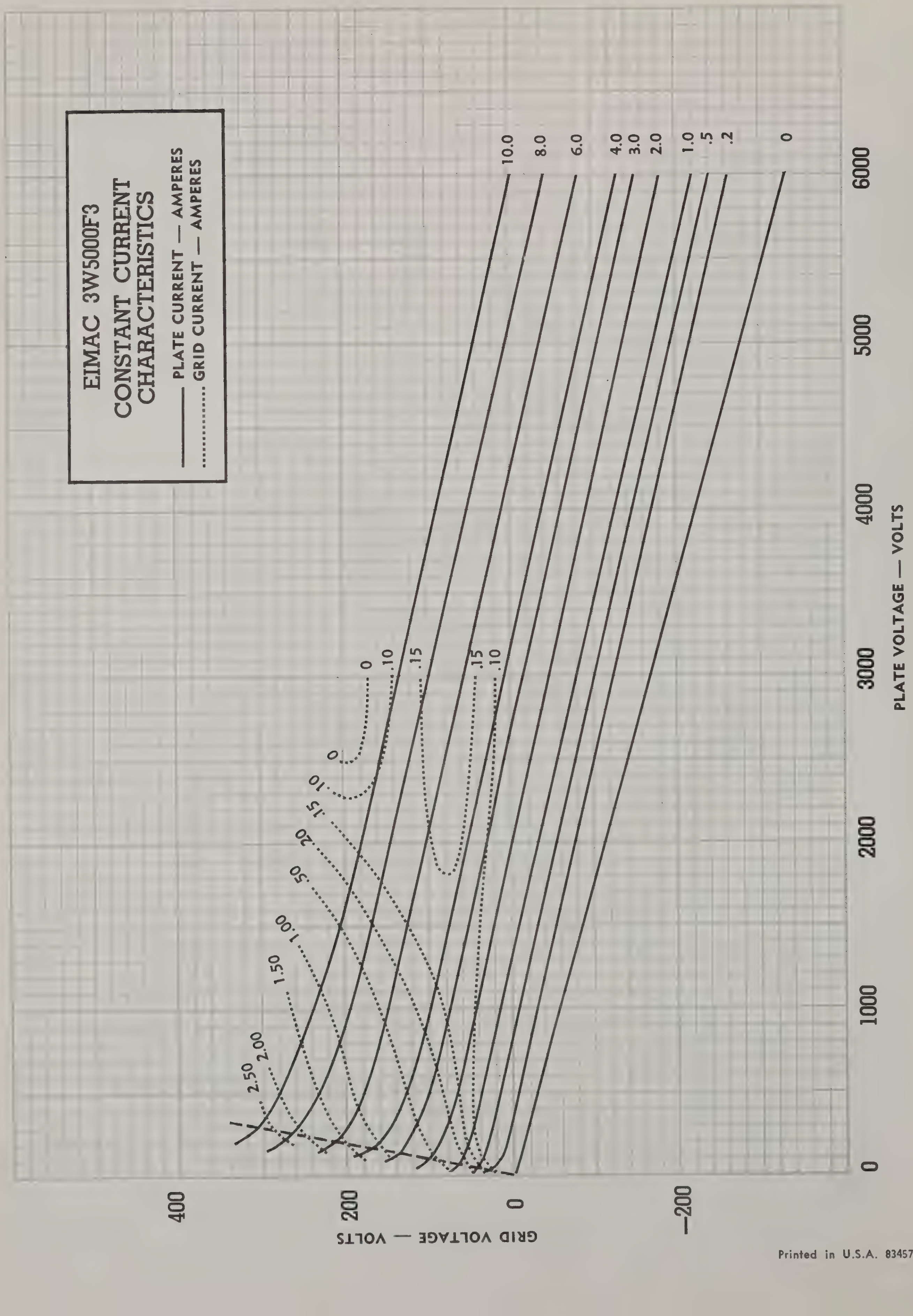
ALL DIMENSIONS IN INCHES

DIMENSION DATA			
REF.	NOM.	MIN.	MAX.
A		3.234	3.266
B			3.625
C		1.062	1.187
D		4.000	4.500
E		7.562	8.062
F		8.937	9.437
G		3.250	3.750
H		3.625	3.875
J		3.937	4.187
K		7.937	8.437
L		.375	.437
M		1.437	1.562
N		.812	.937
P		.812	.937
R		.859	.890
S		7.000	7.500
T		7.000	7.500
U		6.375	6.625
V		.194	.200 ◀
W		.385	.395

DRIVING POWER vs. POWER OUTPUT

The three charts on this page show the relationship of plate efficiency, power output and approximate grid driving power at plate voltages of 4000, 5000 and 6000 volts. These charts show combined grid and bias losses only. The driving-power and power-output figures do not include circuit losses. The plate dissipation in watts is indicated by Pp. Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 4000, 5000 and 6000 volts respectively.

▶ Indicates change from sheet dated 8-26-58.


EIMAC 3W5000F3
CONSTANT CURRENT CHARACTERISTICS
—— PLATE CURRENT — AMPERES
.... GRID CURRENT — AMPERES
10.0
8.0
6.0
4.0
3.0
2.0
1.0
.5
.2
0
0
.10
.15
.15
.10
0
.10
.15
.20
.50
1.00
1.50
2.00
2.50
PLATE VOLTAGE — VOLTS
0
1000
2000
3000
4000
5000
6000
GRID VOLTAGE — VOLTS
400
200
0
–200

Eimac®

EITEL-McCULLOUGH, INC.
SAN CARLOS · CALIFORNIA

3X2500A3
MEDIUM MU TRIODE

The Eimac 3X2500A3 is a medium-mu, forced-air-cooled, external-anode transmitting triode with a maximum plate-dissipation rating of 2500 watts. Relatively high power output as an amplifier, oscillator or modulator may be obtained from this tube at low plate voltages. A single tube will deliver a radio-frequency output of 7500 watts at 4000 plate volts at frequencies up to 110 Mc., as well as at lower frequencies.

The tube has a rugged, low-inductance cylindrical filament-stem structure, which readily becomes part of a linear filament tank circuit for V.H.F. operation. The grid provides thorough shielding between the input and output circuits for grounded-grid applications and is conveniently terminated in a ring between the plate and filament terminals. The 3X2500A3 may be installed or removed without the aid of tools.

The approved Federal Communications Commission rating for the 3X2500A3 is 5000 watts of carrier power when used as a plate-modulated amplifier and 1250 watts of carrier power when used as a grid-modulated or linear amplifier.

GENERAL CHARACTERISTICS

ELECTRICAL

	Min.	Nom.	Max.	
Filament: Thoriated Tungsten				
Voltage		7.5		volts
Current	49		54	amperes
Amplification Factor	19		26	
Direct Interelectrode Capacitances				
Grid-Plate	16.8		23.2	uuf
Grid-Filament	29.2		40.2	uuf
Plate-Filament	0.6		1.2	uuf
Transconductance (I_b=830 ma., E_b=3000 v.)		20,000		umhos
Highest Frequency for Maximum Ratings			75	mc

MECHANICAL

Base	see drawing
Mounting	Vertical, base down or up
Cooling	Forced air
Maximum Anode Cooler Core and Seal Temperatures	150° C
Maximum Over-All Dimensions:	
Length	8.6 inches
Diameter	4.16 inches
Net Weight	6.25 pounds
Shipping Weight (Average)	17 pounds

RADIO-FREQUENCY POWER AMPLIFIER OR OSCILLATOR

(Conventional Neutralized Amplifier—Frequencies below 75Mc.)
Class-C FM or Telegraphy (Key-down conditions, per tube)

MAXIMUM RATINGS	
D-C PLATE VOLTAGE	6000 MAX. VOLTS
D-C PLATE CURRENT	2.5 MAX. AMPS
PLATE DISSIPATION	2500 MAX. WATTS
PLATE COOLER CORE TEMPERATURE	150 MAX. °C
GRID DISSIPATION	150 MAX. WATTS

TYPICAL OPERATION (Frequencies below 75 Mc. per tube)

D-C Plate Voltage	4000	5000	6000	volts
D-C Plate Current	2.5	2.5	2.08	amps
D-C Grid Voltage	—300	—450	—500	volts
D-C Grid Current*	245	265	180	ma
Peak R-F Grid Input Voltage*	580	750	765	volts
Driving Power*	142	197	136	watts
Grid Dissipation*	68	78	46	watts
Plate Power Input	10,000	12,500	12,500	watts
Plate Dissipation	2500	2500	2500	watts
Plate Power Output	7500	10,000	10,000	watts

RADIO-FREQUENCY POWER AMPLIFIER

Grounded-Grid Circuit
Class-C FM Telephony

MAXIMUM RATINGS (Frequencies between 85 and 110 Mc.)	
D-C PLATE VOLTAGE	4000 MAX. VOLTS
D-C PLATE CURRENT	2.0 MAX. AMPS
D-C GRID CURRENT	200 MAX. MA
PLATE DISSIPATION	2500 MAX. WATTS
PLATE COOLER CORE TEMPERATURE	150 MAX. °C
GRID DISSIPATION	150 MAX. WATTS

TYPICAL OPERATION (110 Mc., per tube)

D-C Plate Voltage	3700	4000	volts
D-C Grid Voltage	—450	—500	volts
D-C Plate Current	1.8	1.85	amps
D-C Grid Current*	190	190	ma
Driving Power*	1600	1900	watts
Useful Power Output	6850	7500	watts

PLATE-MODULATED RADIO-FREQUENCY AMPLIFIER

(Conventional Neutralized Amplifier—Frequencies below 75 Mc.)
Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS	
D-C PLATE VOLTAGE	5000 MAX. VOLTS
D-C PLATE CURRENT	2.0 MAX. AMPS
▶ PLATE DISSIPATION	1670 MAX. WATTS
PLATE COOLER CORE TEMPERATURE	150 MAX. °C
GRID DISSIPATION	150 MAX. WATTS

TYPICAL OPERATION (Frequencies below 75 Mc., per tube)

D-C Plate Voltage	4000	4500	5000	volts
D-C Plate Current	1.67	1.47	1.25	amps
D-C Grid Voltage	—450	—500	—550	volts
D-C Grid Current*	180	140	150	ma
Peak R-F Grid Input Voltage*	685	715	760	volts
Driving Power*	125	100	115	watts
Grid Dissipation*	43	30	32	watts
▶ Plate Power Input	6670	6615	6250	watts
Plate Dissipation	1670	1315	950	watts
Plate Power Output	5000	5300	5300	watts

*Approximate values.

▶ Indicates change from sheet dated 12-20-57

(Effective 11-13-58) Copyright, 1958 by Eitel-McCullough, Inc.

AUDIO-FREQUENCY POWER AMPLIFIER OR MODULATOR

Class-AB or B
MAXIMUM RATINGS

D-C PLATE VOLTAGE	6000 MAX. VOLTS
D-C PLATE CURRENT	2.5 MAX. AMPS
PLATE DISSIPATION	2500 MAX. WATTS
GRID DISSIPATION	150 MAX. WATTS

TYPICAL OPERATION (Sinusoidal wave, two tubes unless noted)

D-C Plate Voltage	4000	5000	6000	volts
D-C Grid Voltage[1]	—150	—190	—240	volts
Zero-Signal D-C Plate Current	0.6	0.5	0.4	amps
Max-Signal D-C Plate Current	4.0	3.2	3.0	amps
Effective Load, Plate to Plate	2200	3600	4650	ohms
Peak A-F Grid Input Voltage (per tube)*	340	360	390	volts
Max-Signal Peak Driving Power*	340	230	225	watts
Max-Signal Nominal Driving Power*	170	115	113	watts
Max-Signal Plate Output Power	11,000	11,000	13,000	watts

*Approximate values.

[1] Adjust to give listed zero-signal plate current.

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER "TYPICAL OPERATION", POSSIBLY EXCEEDING THE MAXIMUM RATINGS GIVEN FOR CW SERVICE, WRITE EITEL-McCULLOUGH, INC., FOR INFORMATION AND RECOMMENDATIONS

APPLICATION

Cooling—Forced-air cooling must be provided to hold the glass-to-metal seals and the anode cooler core below the maximum rated temperature of 150° C. Although the air requirements stated below are sufficient to maintain rated tube temperatures under many conditions, air in excess of the amounts shown will usually result in longer tube life. At ambient temperatures higher than 40° C, at high altitudes, and at operating frequencies above 75 megacycles, additional air flow must be provided. In all cases, tube temperatures are the criteria which govern air requirements. Surface temperatures may be measured conveniently with the aid of temperature-sensitive paints.

The minimum air-flow requirement for the anode cooler at the maximum rated plate dissipation of 2500 watts and with an inlet-air temperature of 20° C is 125 CFM. At sea level the pressure drop across the cooler for this air flow is 2.3 inches.

Under the same conditions, a minimum air-flow rate of 6 CFM directed into the filament-stem structure between the inner and outer filament terminals is required to maintain the base seals at 150° C.

Simultaneous removal of all power and air (as in the case of a power failure) will not ordinarily injure the tube, but it is not recommended as a standard operating practice.

Filament Voltage—The filament voltage, as measured directly at the tube, should be 7.5 volts with maximum allowable variations due to line fluctuation of from 7.12 to 7.87 volts.

Bias Voltage—There is little advantage in using bias voltages in excess of those given under "Typical Operation", except in certain very specialized applications. Where bias is obtained from a grid resistor, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation.

Plate Voltage—The plate-supply voltage for the 3X2500A3 should not exceed 6000 volts. In most cases there is little advantage in using plate-supply voltages higher than those given under "Typical Operation" for the power output desired.

In Class-C FM or Telegraphy service, a 0.1—henry choke, shunted by a spark gap, should be series connected between the plates of the amplifier tubes and the high-voltage plate-supply capacitor to offer protection from transients and surges. In plate-modulated service, where a plate-modulation transformer is used, the protective choke is not normally required.

Grid Dissipation—The power dissipated by the grid of the 3X2500A3 must never exceed 150 watts. Grid dissipation may be calculated from the following expression:

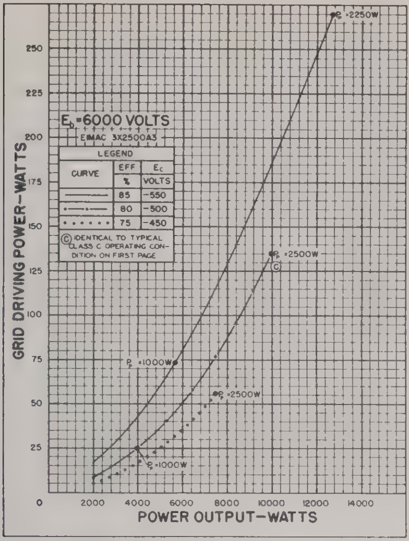
$$P_g = e_{cmp} I_c$$

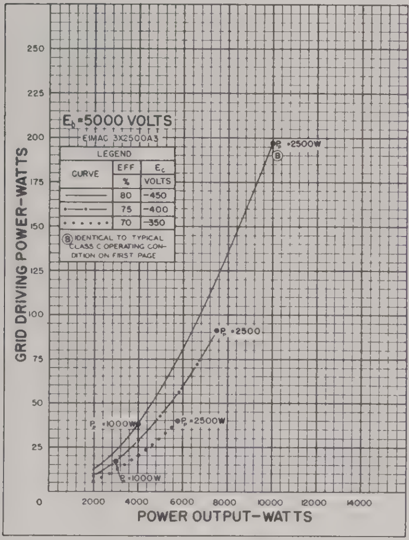
where: P_g=Grid dissipation,
e_{cmp}=Peak positive grid voltage, and
I_c=D-C grid current.

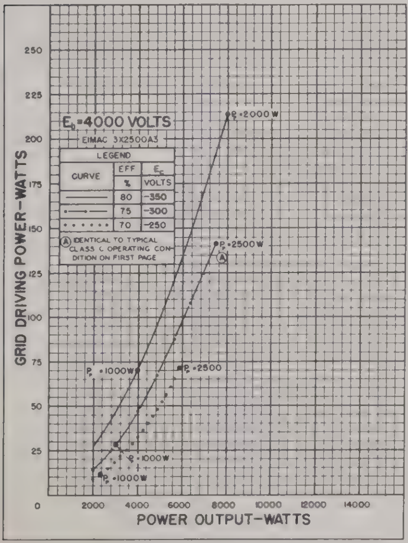
e_{cmp} may be measured by means of a suitable peak voltmeter connected between filament and grid. Any suitable peak v.t.v.m. circuit may be used.

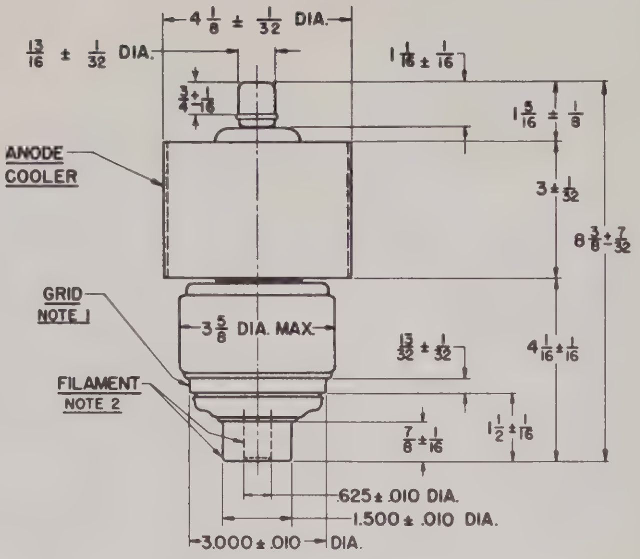
In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading.

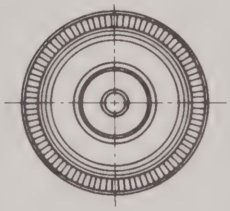
In VHF operation, particularly above 75 Mc., the d-c grid current must not exceed 200 ma. under any conditions of plate loading. With lightly loaded conditions the grid driving power should be reduced so that the grid current does not exceed one-tenth of the plate current.









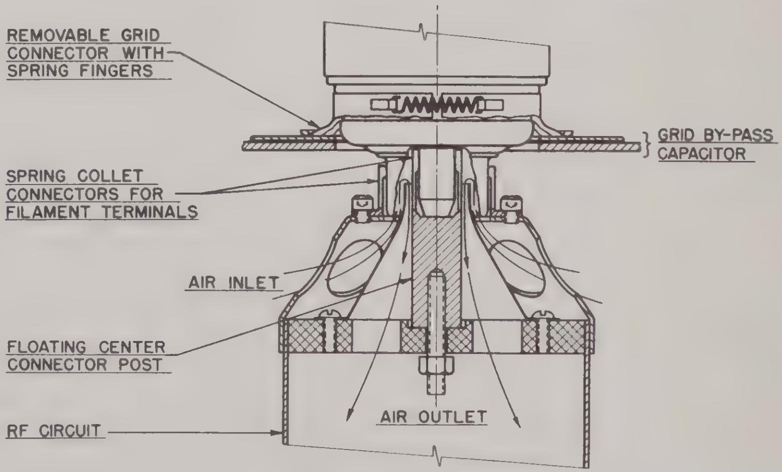


BOTTOM VIEW

DIMENSIONS IN INCHES

NOTE 1
.040" MAXIMUM RUNOUT OF GRID CONTACT SURFACE WITH RESPECT TO AXIS DETERMINED BY ANODE AND OUTER FILAMENT CONTACT SURFACE.

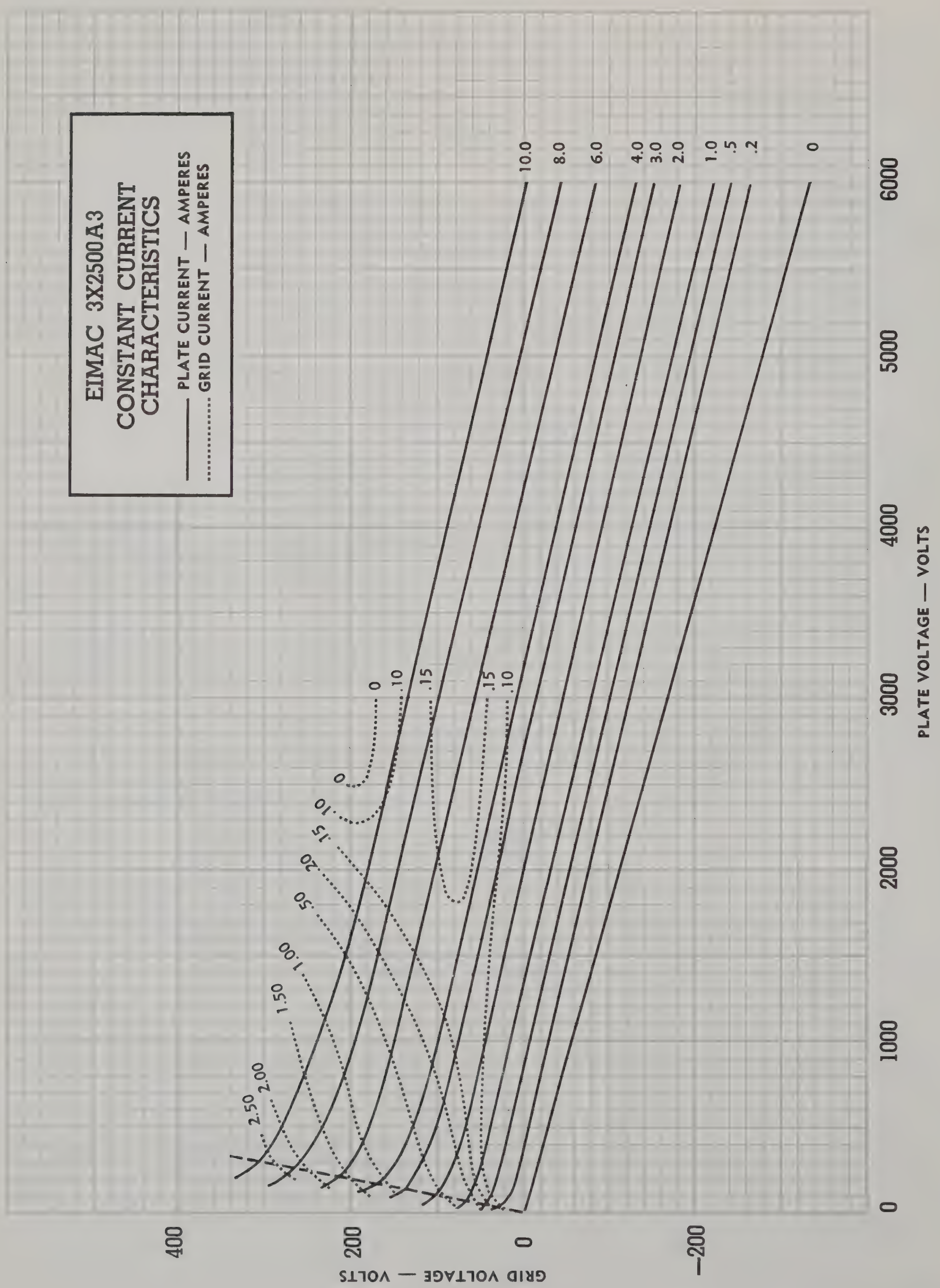
NOTE 2
.025" MAXIMUM RUNOUT OF INNER FILAMENT CONTACT SURFACE WITH RESPECT TO TO OUTER FILAMENT CONTACT SURFACE.


REMOVABLE GRID CONNECTOR WITH SPRING FINGERS
GRID BY-PASS CAPACITOR
SPRING COLLET CONNECTORS FOR FILAMENT TERMINALS
AIR INLET
FLOATING CENTER CONNECTOR POST
RF CIRCUIT
AIR OUTLET

TYPICAL TUBE CONNECTORS AND STEM COOLING

DRIVING POWER vs. POWER OUTPUT

The three charts on this page show the relationship of plate efficiency, power output and approximate grid driving power at plate voltages of 4000, 5000 and 6000 volts. These charts show combined grid and bias losses only. The driving-power and power-output figures do not include circuit losses. The plate dissipation in watts is indicated by Pp. Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 4000, 5000 and 6000 volts respectively.



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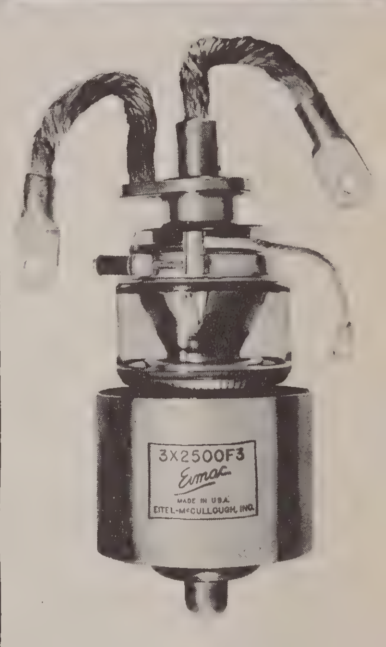
EITEL-McCULLOUGH, INC.

SAN BRUNO, CALIFORNIA

3X2500F3

MEDIUM MU TRIODE



The Eimac 3X2500F3 is a medium-mu, forced-air cooled, external-anode power triode intended for amplifier, oscillator and modulator service. It has a maximum plate dissipation rating of 2500 watts and is capable of high output at relatively low plate voltages. A single 3X2500F3 will deliver a radio frequency plate power-output of 7500 watts at a plate voltage of 4000 volts.

The tube is equipped with flexible filament and grid leads which simplifies socketing and equipment design for industrial and communication frequencies below 30 Mc.

The approved Federal Communications Commission rating for the 3X2500F3 as a plate modulated amplifier is 5000 watts of carrier power.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated tungsten	
Voltage	7.5 volts
Current	51 amperes
Amplification Factor (Average)	20
Direct Interelectrode Capacitances (Average)	
Grid-Plate	20 μμfd
Grid-Filament	36 μμfd
Plate-Filament	1.2 μμfd
Transconductance (i_b = 830 ma., E_b = 3000 v.)	20,000 μmhos
Frequency for Maximum Ratings	30 Mc

MECHANICAL

Base	See Drawing
Mounting	Vertical, base down or up
Maximum Overall Dimensions:	
Length (does not include filament connectors)	9.0 inches
Diameter	4.156 inches
Net weight	7.5 pounds
Shipping weight (Average)	17 pounds

▶ Cooling

A minimum flow of 120 cubic feet of air per minute must be passed through the anode cooler. The pressure drop across the cooler at this flow equals 1.0 inch of water. A minimum air-flow of 6 cubic feet per minute must also be directed toward the filament-stem structure, between the inner and outer filament conductors. Cooling air in the above quantities must be supplied to both anode cooler and filament seals before applying filament voltage and should be continued for one minute after the filament power is removed. Anode-cooler core, grid and filament seal temperatures must not exceed 150° C. These figures are for an ambient temperature of 20° C at sea level and do not include duct or filter losses.

RADIO-FREQUENCY POWER AMPLIFIER OR OSCILLATOR

▶ (Conventional Neutralized Amplifier—Frequencies below 30 Mc.)

Class-C FM or Telegraphy (Key-down conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	6000	MAX. VOLTS
D-C PLATE CURRENT	2.5	MAX. AMPS
PLATE DISSIPATION	2500	MAX. WATTS
PLATE COOLER CORE TEMPERATURE	150	MAX. ° C
GRID DISSIPATION*	150	MAX. WATTS

* SEE APPLICATION NOTES.

TYPICAL OPERATION (Frequencies below 30 Mc. per tube)

D-C Plate Voltage	4000	5000	6000	volts
D-C Plate Current	2.5	2.5	2.08	amps
D-C Grid Voltage	−300	−450	−500	volts
D-C Grid Current	245	265	180	ma
Peak R-F Grid Input Voltage	580	750	765	volts
Driving Power (approx.)	142	197	136	watts
Grid Dissipation	68	78	46	watts
Plate Power Input	10,000	12,500	12,500	watts
Plate Dissipation	2500	2500	2500	watts
Plate Power Output	7500	10,000	10,000	watts

PLATE-MODULATED RADIO-FREQUENCY AMPLIFIER

▶ (Conventional Neutralized Amplifier—Frequencies below 30 Mc.)

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	5000	MAX. VOLTS
D-C PLATE CURRENT	2.0	MAX. AMPS
PLATE DISSIPATION	1670	MAX. WATTS
PLATE COOLER CORE TEMPERATURE	150	MAX. ° C
GRID DISSIPATION	150	MAX. WATTS

TYPICAL OPERATIONS (Frequencies below 30 Mc. per tube)

D-C Plate Voltage	4000	4500	5000	volts
D-C Plate Current	1.67	1.55	1.45	amps
Total Bias Voltage	−450	−500	−550	volts
Fixed Bias Voltage	−230	−325	−410	volts
Grid Resistor	1500	1500	1400	ohms
D-C Grid Current	150	120	100	ma
Peak R-F Grid Input Voltage	680	720	760	volts
Driving Power (approx.)	102	86	76	watts
Grid Dissipation	35	26	21	watts
Plate Power Input	6670	6970	7250	watts
Plate Dissipation	1670	1670	1670	watts
Plate Power Output	5000	5300	5580	watts

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER "TYPICAL OPERATION," POSSIBLY EXCEEDING THE MAXIMUM RATINGS GIVEN FOR CW SERVICE, WRITE EITEL-McCULLOUGH, INC., FOR INFORMATION AND RECOMMENDATIONS.

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▶ Indicates Change from Sheet Dated 2-1-50

AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR

Class B (Sinusoidal wave, two tubes unless otherwise specified)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	6000	MAX. VOLTS
MAX.-SIGNAL D-C PLATE CURRENT, PER TUBE	2.5	MAX. AMPS
PLATE DISSIPATION, PER TUBE	2500	MAX. WATTS
PLATE COOLER CORE TEMPERATURE	150	MAX. ° C

TYPICAL OPERATION CLASS AB₂ (Two tubes)

D-C Plate Voltage	4000	5000	6000	volts
D-C Grid Voltage (approx.)*	–150	–190	–240	volts
Zero-Signal D-C Plate Current	0.6	0.5	0.4	amps
Max.-Signal D-C Plate Current	4.0	3.2	3.0	amps
Effective Load, Plate to Plate	2200	3600	4650	ohms
Peak A-F Grid Input Voltage (per tube)	340	360	390	volts
Max.-Signal Peak Driving Power	340	230	225	watts
Max.-Signal Nominal Driving Power (approx.)	170	115	113	watts
Max.-Signal Plate Power Output	11,000	11,000	13,000	watts

TYPICAL OPERATION CLASS AB₂ (Two tubes)

(Modulator service for 4000 and 5000 volt operation, to modulate one or two tubes, as shown under "Plate Modulated Radio Frequency Amplifier.")

D-C Plate Voltage	4000	5000	4000	5000	volts
D-C Grid Voltage (approx.)*	–155	–200	–145	–190	volts
Zero-Signal D-C Plate Current	0.4	0.4	0.6	0.5	amps
Max.-Signal D-C Plate Current	1.35	1.13	2.70	2.26	amps
Effective Load, Plate to Plate	6600	10,000	3300	5000	ohms
Peak A-F Grid Input Voltage (per tube)	240	275	285	310	volts
Max.-Signal Peak Driving Power	42	40	134	118	watts
Max.-Signal Nominal Driving Power (approx.)	21	20	67	59	watts
Max.-Signal Plate Power Output	3700	4000	7400	8000	watts
Will Modulate R. F. Final Input of	6670	7250	13,340	14,500	watts

*Adjust to give stated zero-signal plate current.

APPLICATION

Filament Voltage—The filament voltage, as measured directly at the tube, should be 7.5 volts with maximum allowable variations due to line fluctuation of from 7.12 to 7.87 volts.

Bias Voltage—There is little advantage in using bias voltages in excess of those given under "Typical Operation," except in certain very specialized applications. Where bias is obtained from a grid resistor, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation.

Plate Voltage — The plate-supply voltage for the 3X2500F3 should not exceed 6000 volts. In most cases there is little advantage in using plate-supply voltages higher than those given under "Typical Operation" for the power output desired.

In Class-C FM or Telegraphy service, a 0.1 henry choke, shunted by a spark gap, should be series connected between the plates of the amplifier tubes and the high-voltage-plate-supply capacitor to offer protection from transients and surges. In plate-modulated service, where a plate-modulation transformer is used, the protective choke is not normally required.

Grid Dissipation—The power dissipated by the grid of the 3X2500F3 must never exceed 150 watts. Grid dissipation may be calculated from the following expression:

$$P_g = e_{cmp} I_c$$

where P_g = grid dissipation,

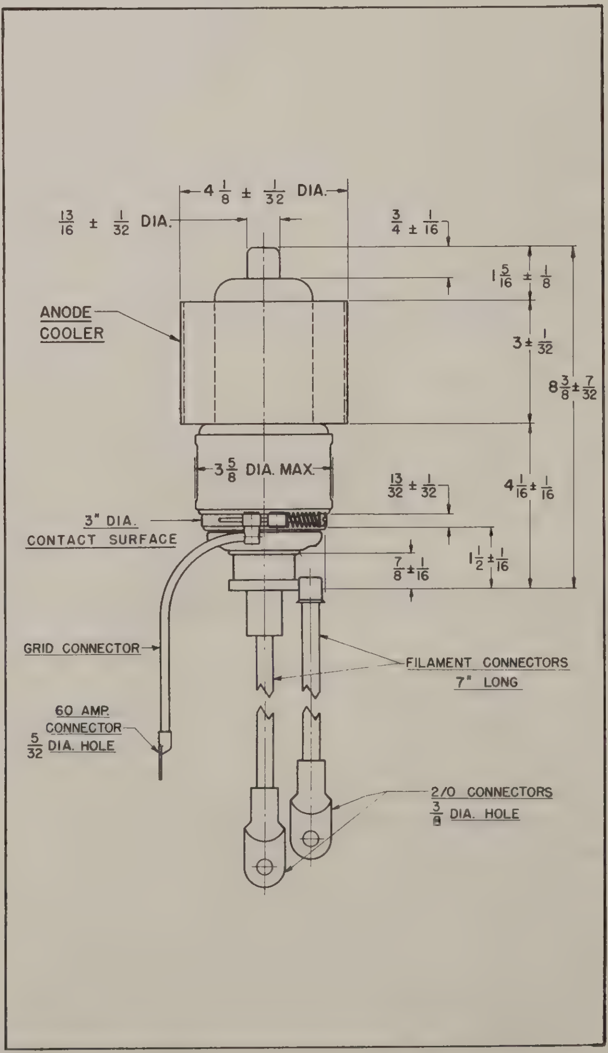
e_{cmp} = peak positive grid voltage, and

I_c = d-c grid current.

e_{cmp} may be measured by means of a suitable peak voltmeter connected between filament and grid. Any suitable peak v.t.v.m. circuit may be used (one is shown in "Vacuum Tube Ratings," Eimac News, January 1945. This article is available, in reprint form on request).

In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading.

▶

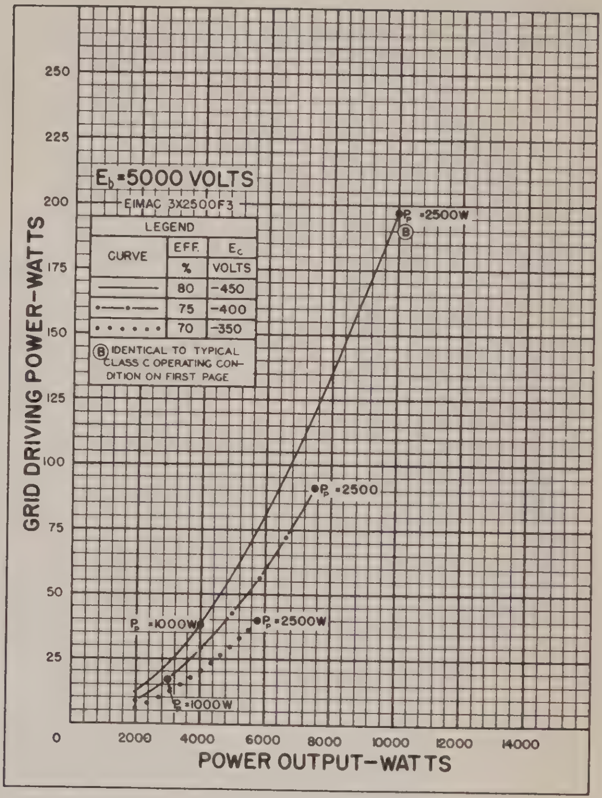


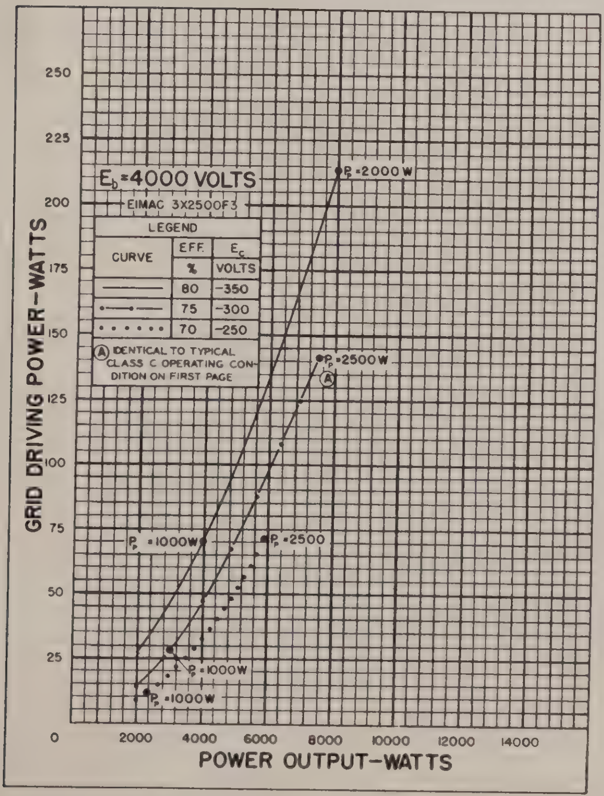
▶ Indicates Change from Sheet Dated 2-1-50

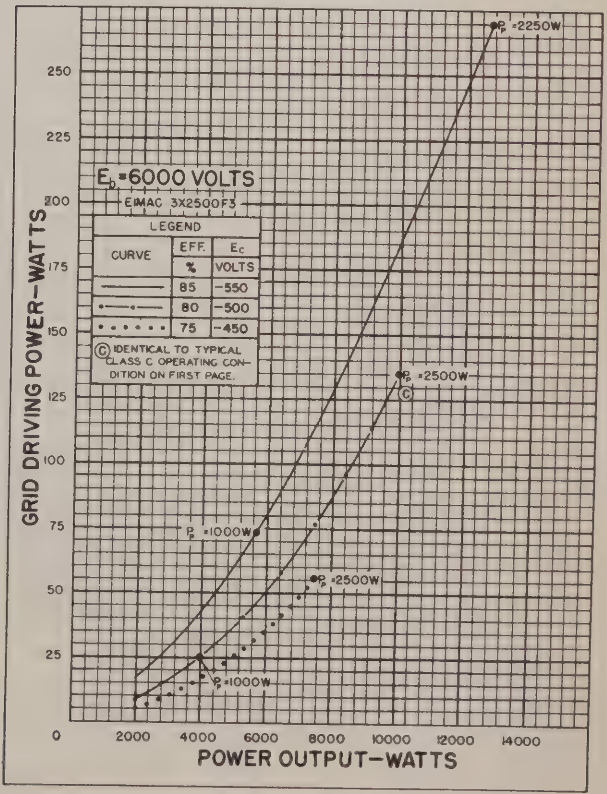
DRIVING POWER vs. POWER OUTPUT

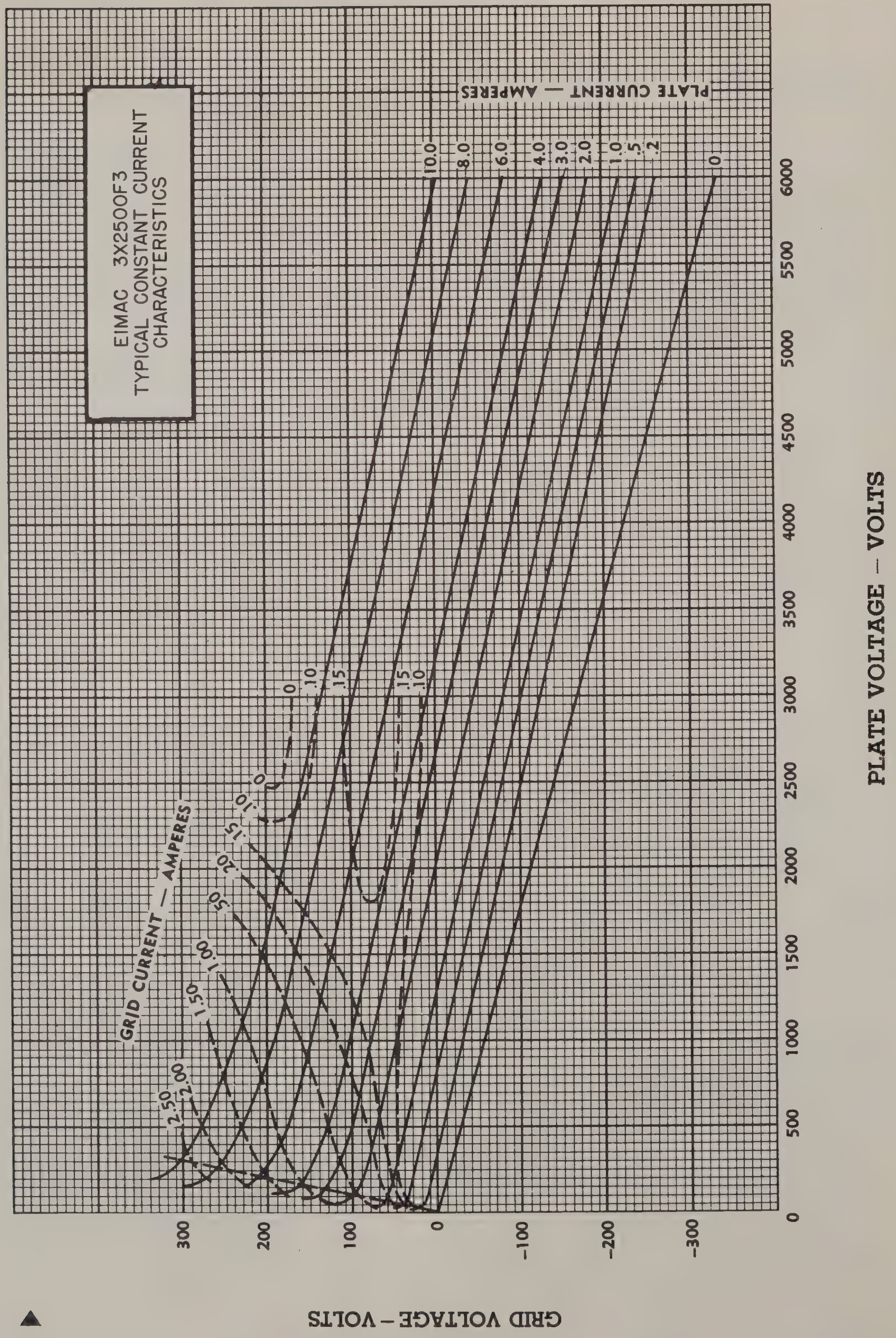
The three charts on this page show the relationship of plate efficiency, power output and grid driving-power at plate voltages of 4000, 5000 and 6000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 4000, 5000 and 6000 volts respectively.









▶ Indicates Change from Sheet Dated 2-1-50

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

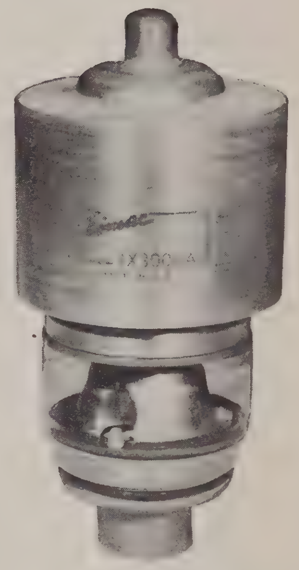
3X3000A1

LOW-MU TRIODE

MODULATOR AMPLIFIER

The Eimac 3X3000A1 is a low-mu forced-air-cooled power triode intended for use as an audio amplifier or modulator. The maximum rated plate dissipation is 3000 watts.

Two 3X3000A1's in class-AB$_1$ audio service will deliver up to 10 kilowatts maximum-signal plate power output at 6000 plate volts without drawing grid current.



GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten	
Voltage	7.5 volts
Current	51 amperes
Amplification Factor (Average)	5
Direct Interelectrode Capacitances (Average)	
Grid-Plate	17 μμfd
Grid-Filament	29 μμfd
Plate-Filament	2.5 μμfd
Transconductance (I_b = 1.0 amp., E_b = 3000v.)	11,000 μmhos

MECHANICAL

Base	See outline drawing
Mounting Position	Vertical, base down or up
Cooling	Forced air
Maximum Temperatures:	
Grid and Filament Seals, Anode Cooler Core	150°C
Maximum Overall Dimensions:	
Length	9.0 inches
Diameter	4.16 inches
Net Weight	6.25 pounds
Shipping Weight (Average)	16 pounds

AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR

Class-AB$_1$

MAXIMUM RATINGS (Per tube)

D-C PLATE VOLTAGE	6000 MAX. VOLTS
D-C PLATE CURRENT	2.5 MAX. AMPERES
PLATE DISSIPATION	3000 MAX. WATTS
GRID DISSIPATION	50 MAX. WATTS

TYPICAL OPERATION (Sinusoidal wave, two tubes unless otherwise specified)

D-C Plate Voltage	3000	4000	5000	6000	volts
D-C Grid Voltage (approx.)[1]	−600	−860	−1080	−1300	volts
Zero-Signal D-C Plate Current	665	500	400	335	ma
Max-Signal D-C Plate Current	3.35	3.00	2.80	2.65	amps
Effective Load, Plate-to-Plate	1170	2160	3320	4560	ohms
Peak A-F Grid Input Voltage (per tube)	555	760	995	1250	volts
Max-Signal Driving Power (approx.)	0	0	0	0	watts
Max-Signal Plate Power Input	10,000	12,000	14,000	16,000	watts
Max-Signal Plate Dissipation (per tube)	3000	3000	3000	3000	watts
Max-Signal Plate Power Output	4000	6000	8000	10,000	watts
Total Harmonic Distortion[2]	2.7	1.8	2.6	2.1	per cent

[1] Adjust to stated Zero-Signal D-C Plate Current. Effective grid-circuit resistance must not exceed 200,000 ohms.
[2] At maximum signal without negative feedback.

APPLICATION

Filament Voltage—The filament voltage, as measured directly at the tube, should be the rated value of 7.5 volts. Variations should be held within the range of 7.12 to 7.87 volts.

Cooling—The 3X3000A1 requires an air-flow of 150 cubic feet per minute through the anode cooler. This corresponds to a pressure drop across the cooler of 2.2 inches of water. A flow of 6 cubic feet per minute must also be directed into the filament stem structure, between the inner and outer filament conductors.

The air-flow must be started when power is applied to the filament, and must continue without interruption until all electrode voltages have been removed from the tube. It is advisable to permit the air-cooling system to operate for two minutes or more after the removal of power.

These air requirements are based upon operation at an ambient temperature of 20°C and at sea level.

Cooling conditions for the 3X3000A1 may be considered satisfactory if the temperature of the anode cooler core and of the metal parts of the metal-to-glass seals is not allowed to exceed 150°C. A convenient accessory for the measurement of these temperatures is "Tempilaq", a temperature-sensitive lacquer manufactured by the Tempil Corporation, 132 West 22nd St., New York 11, N. Y.

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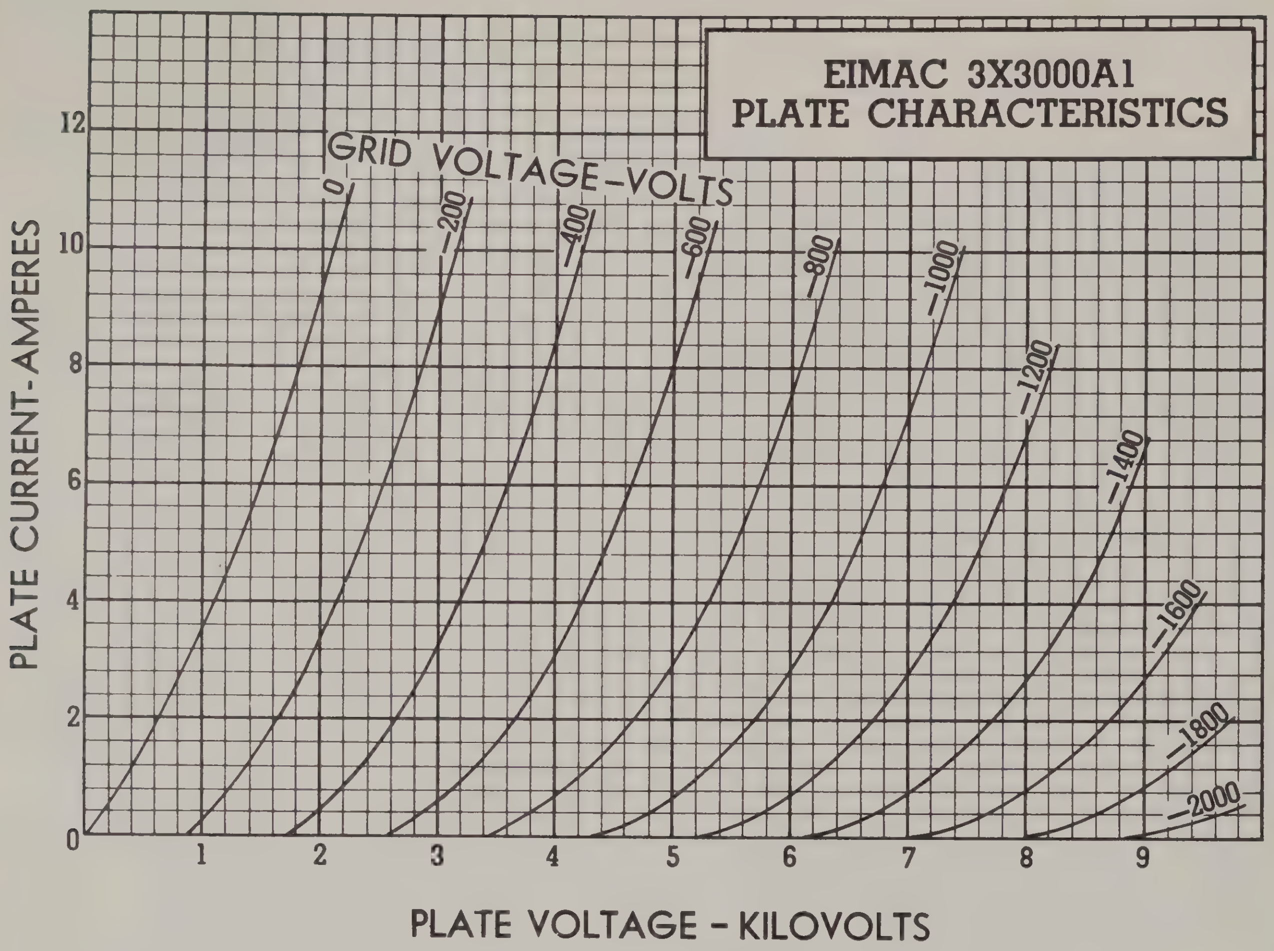
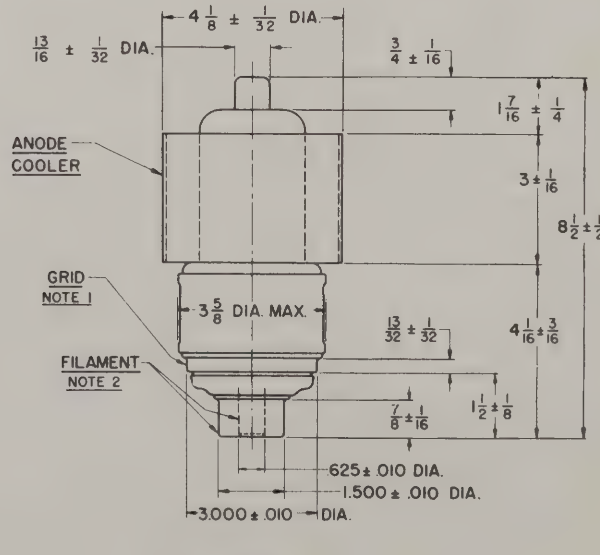
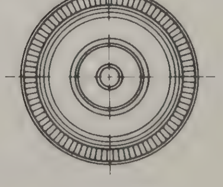


NOTE 1
.040" MAXIMUM RUNOUT OF GRID CONTACT SURFACE WITH RESPECT TO AXIS DETERMINED BY ANODE AND OUTER FILAMENT CONTACT SURFACE.

NOTE 2
.025" MAXIMUM RUNOUT OF INNER FILAMENT CONTACT SURFACE WITH RESPECT TO TO OUTER FILAMENT CONTACT SURFACE.





BOTTOM VIEW

DIMENSIONS IN INCHES

Printed in U.S.A. 3-EI-76228

Eimac®

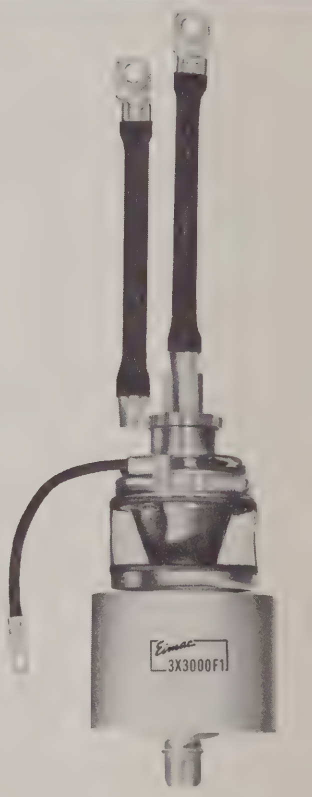
EITEL-McCULLOUGH, INC.
SAN CARLOS · CALIFORNIA

3X3000F1

LOW-MU TRIODE
•
MODULATOR AMPLIFIER

The Eimac 3X3000F1 is a low-mu forced-air-cooled power triode intended for use as an audio amplifier or modulator. The maximum rated plate dissipation is 3000 watts.

Two 3X3000F1's in class-AB$_1$ audio service will deliver up to 10 kilowatts maximum-signal plate output power at 6000 plate volts without drawing grid current.



GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten	Min.	Nom.	Max.	
Voltage		7.5		volts
Current	49		54	amperes
Amplification Factor	4.4		5.6	
Direct Interelectrode Capacitances (Average)				
Grid-Plate		17		uufd
Grid-Filament		29		uufd
Plate-Filament		2.5		uufd
Transconductance (I_b=1.0 amp., E_b=3000v.)		11,000		umhos

MECHANICAL

Base	See outline drawing
Mounting Position	Vertical, base down or up
Cooling	Forced air
Maximum Temperatures: Grid and Filament Seals, Anode Cooler Core	150° C
Maximum Diameter	4.16 inches
Net Weight	7.5 pounds
Shipping Weight	17 pounds

AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR

Class-AB$_1$

MAXIMUM RATINGS (Per tube)

D-C PLATE VOLTAGE	6000 MAX. VOLTS
D-C PLATE CURRENT	2.5 MAX. AMPERES
PLATE DISSIPATION	3000 MAX. WATTS
GRID DISSIPATION	50 MAX. WATTS

TYPICAL OPERATION (Sinusoidal wave, two tubes unless otherwise specified)

D-C Plate Voltage	3000	4000	5000	6000	volts
D-C Grid Voltage (approx.)[1]	—600	—860	—1080	—1300	volts
Zero-Signal D-C Plate Current	665	500	400	335	ma
Max-Signal D-C Plate Current	3.35	3.00	2.80	2.65	amps
Effective Load, Plate-to-Plate	1170	2160	3320	4560	ohms
Peak A-F Grid Input Voltage (per tube)	555	760	995	1250	volts
Max-Signal Driving Power (approx.)	0	0	0	0	watts
Max-Signal Plate Input Power	10,000	12,000	14,000	16,000	watts
Max-Signal Plate Dissipation (per tube)	3000	3000	3000	3000	watts
Max-Signal Plate Output Power	4000	6000	8000	10,000	watts
Total Harmonic Distortion[2]	2.7	1.8	2.6	2.1	per cent

[1] Adjust to stated Zero-Signal D-C Plate Current. Can be expected to vary ±15%. Effective grid-circuit resistance must not exceed 200,000 ohms.

[2] At maximum signal without negative feedback.

APPLICATION

Filament Voltage—The filament voltage, as measured directly at the tube, should be 7.5 volts with maximum allowable variations due to line fluctuation of from 7.12 to 7.87 volts.

Cooling—The 3X30000F1 requires an air-flow of 160 cubic feet per minute through the anode cooler. This corresponds to a pressure drop across the cooler of 3.6 inches of water. A flow of 6 cubic feet per minute must also be directed into the filament stem structure, between the inner and outer filament conductors.

The air-flow must be started when power is applied to the filament, and must continue without interruption until all electrode voltages have been removed from the tube. It is advisable to permit the air-cooling system to operate for two minutes or more after the removal of power.

These air requirements are based upon operation at an ambient temperature of 20°C and at sea level.

Cooling conditions for the 3X3000F1 may be considered satisfactory if the temperature of the anode cooler core and of the metal parts of the metal-to-glass seals is not allowed to exceed 150°C. Surface temperatures may be easily and effectively measured by using one of the several temperature-sensitive paints or sticks available from various chemical or scientific-equipment suppliers.

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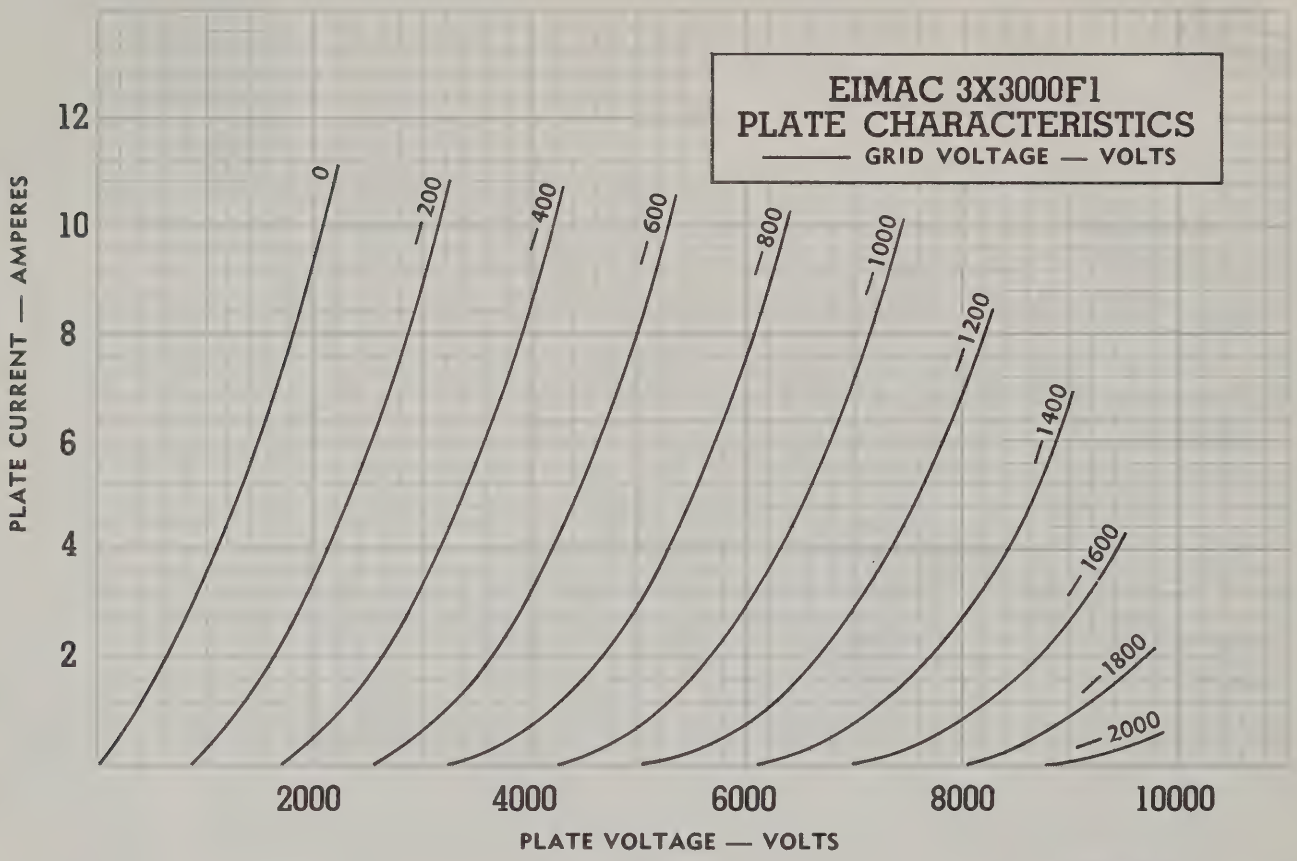

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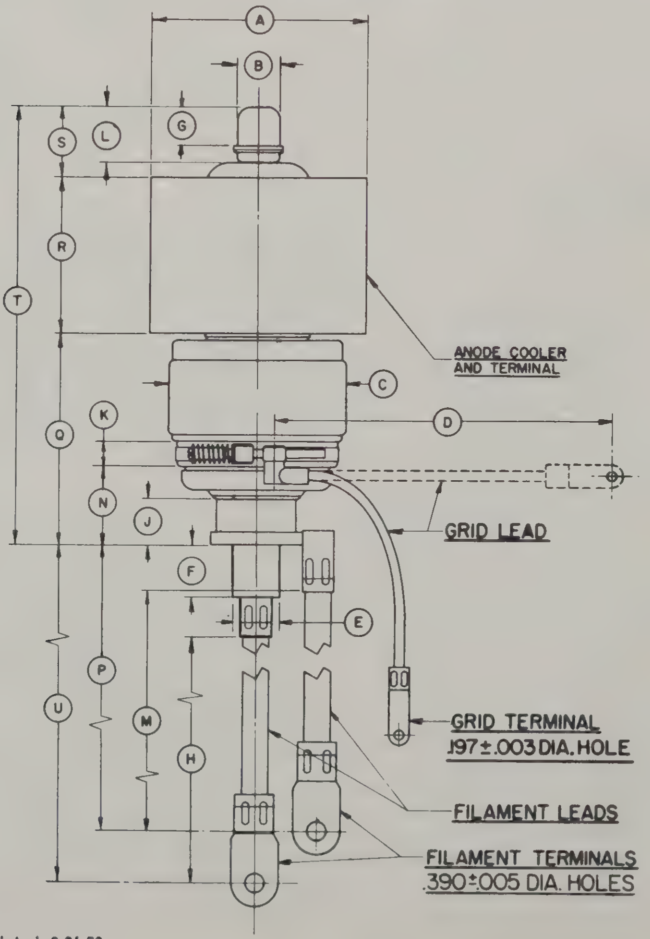
A
B
C
D
E
F
G
H
J
K
L
M
N
P
Q
R
S
T
U
ANODE COOLER AND TERMINAL
GRID LEAD
GRID TERMINAL .197±.003 DIA. HOLE
FILAMENT LEADS
FILAMENT TERMINALS .390±.005 DIA. HOLES

DIMENSION DATA			
REF.	NOM	MIN	MAX
A		4 3/32	4 5/32
B		25/32	27/32
C			3 5/8
D		6 3/8	6 5/8
E		55/64	57/64
F		13/16	15/16
G		11/16	13/16
H		7	7 1/2
J		13/16	15/16
K		3/8	7/16
L		1	1 1/8
M		7	7 1/2
N		1 7/16	1 9/16
P		7 15/16	8 7/16
Q		4	4 1/8
R		2 31/32	3 1/32
S		1 3/16	1 7/16
T		8 5/32	8 19/32
U		8 15/16	9 7/16

ALL DIMENSIONS IN INCHES

▶ Indicates change from sheet dated 8-26-58.

Printed in U.S.A. 83457

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

25T

MEDIUM-MU TRIODE
•
MODULATOR
OSCILLATOR
AMPLIFIER

▶ The Eimac 25T is a medium-mu, power triode having a maximum plate dissipation of 25 watts and is intended for use as an amplifier, oscillator or modulator. It can be used at its maximum ratings at frequencies as high as 60 Mc.

Cooling of the 25T is accomplished by radiation from the plate, which operates at a visible red color at maximum dissipation and by means of air convection around the envelope.

GENERAL CHARACTERISTICS

▶ ELECTRICAL

Filament: Thoriated tungsten	
Voltage	6.3 volts
Current	3.0 amperes
Amplification Factor (Average)	24
Direct Interelectrode Capacitances (Average)	
Grid-Plate	1.5 $\mu\mu$f
Grid-Filament	2.2 $\mu\mu$f
Plate-Filament	0.2 $\mu\mu$f
Transconductance (i_b=25 ma., E_b=1000 v.)	2500 μmhos
Frequency for Maximum Ratings	60 Mc.

▶ MECHANICAL

Base	Small 4-pin, RMA type A4-5
Basing (See outline drawing)	RMA type 3G
Mounting	Vertical, base down or up
Cooling	Convection and Radiation
Recommended Heat Dissipating Connector:	
Plate	HR-1
Maximum Overall Dimensions:	
Length	4.38 inches
Diameter	1.44 inches
Net Weight	1.5 ounces
Shipping Weight (Average)	1.0 pound

▶ AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class-B

MAXIMUM RATINGS, PER TUBE

D-C PLATE VOLTAGE	2000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT	75 MAX. MA.
PLATE DISSIPATION	25 MAX. WATTS
GRID DISSIPATION	7 MAX. WATTS

TYPICAL OPERATION, CLASS AB_2
Sinusoidal wave, two tubes unless otherwise specified

D-C Plate Voltage	750	1000	1250	Volts
D-C Grid Voltage (approx.)*	—20	—30	—42	Volts
Zero-Signal D-C Plate Current	43	32	24	Ma.
Max-Signal D-C Plate Current	127	127	130	Ma.
Effective Load, Plate-to-Plate	12,000	17,000	21,400	Ohms
Peak A-F Grid Input Voltage (per tube)	110	120	135	Volts
Max-Signal Peak Driving Power	5.5	6.0	6.8	Watts
Max-Signal Nominal Driving Power (approx.)	2.8	3.0	3.4	Watts
Max-Signal Plate Power Output	60	85	112	Watts

*Adjust to give stated zero-signal plate current.

▶ PLATE MODULATED RADIO FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	1600 MAX. VOLTS
D-C PLATE CURRENT	60 MAX. MA.
PLATE DISSIPATION	17 MAX. WATTS
GRID DISSIPATION	7 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	1000	1250	1600	Volts
D-C Plate Current	60	60	53	Ma.
D-C Grid Voltage	—120	—140	—170	Volts
D-C Grid Current	14	13	11	Ma.
Peak R-F Grid Input Voltage	235	255	280	Volts
Driving Power	3.3	3.3	3.1	Watts
Grid Dissipation	1.6	1.5	1.2	Watts
Plate Power Input	60	75	85	Watts
Plate Dissipation	13	15	17	Watts
Plate Power Output	47	60	68	Watts

The above figures show actual measured tube performance and do not allow for variations in circuit losses.

▶ RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony (Key-down conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	2000 MAX. VOLTS
D-C PLATE CURRENT	75 MAX. MA.
PLATE DISSIPATION	25 MAX. WATTS
GRID DISSIPATION	7 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	1000	1500	2000	Volts
D-C Plate Current	72	67	63	Ma.
D-C Grid Voltage	—70	—95	—130	Volts
D-C Grid Current	9	13	18	Ma.
Peak R-F Grid Input Voltage	170	195	245	Volts
Driving Power	1.3	2.2	4.0	Watts
Grid Dissipation	.9	1.3	2.1	Watts
Plate Power Input	72	100	125	Watts
Plate Dissipation	25	25	25	Watts
Plate Power Output	47	75	100	Watts

The above figures show actual measured tube performance and do not allow for variations in circuit losses.

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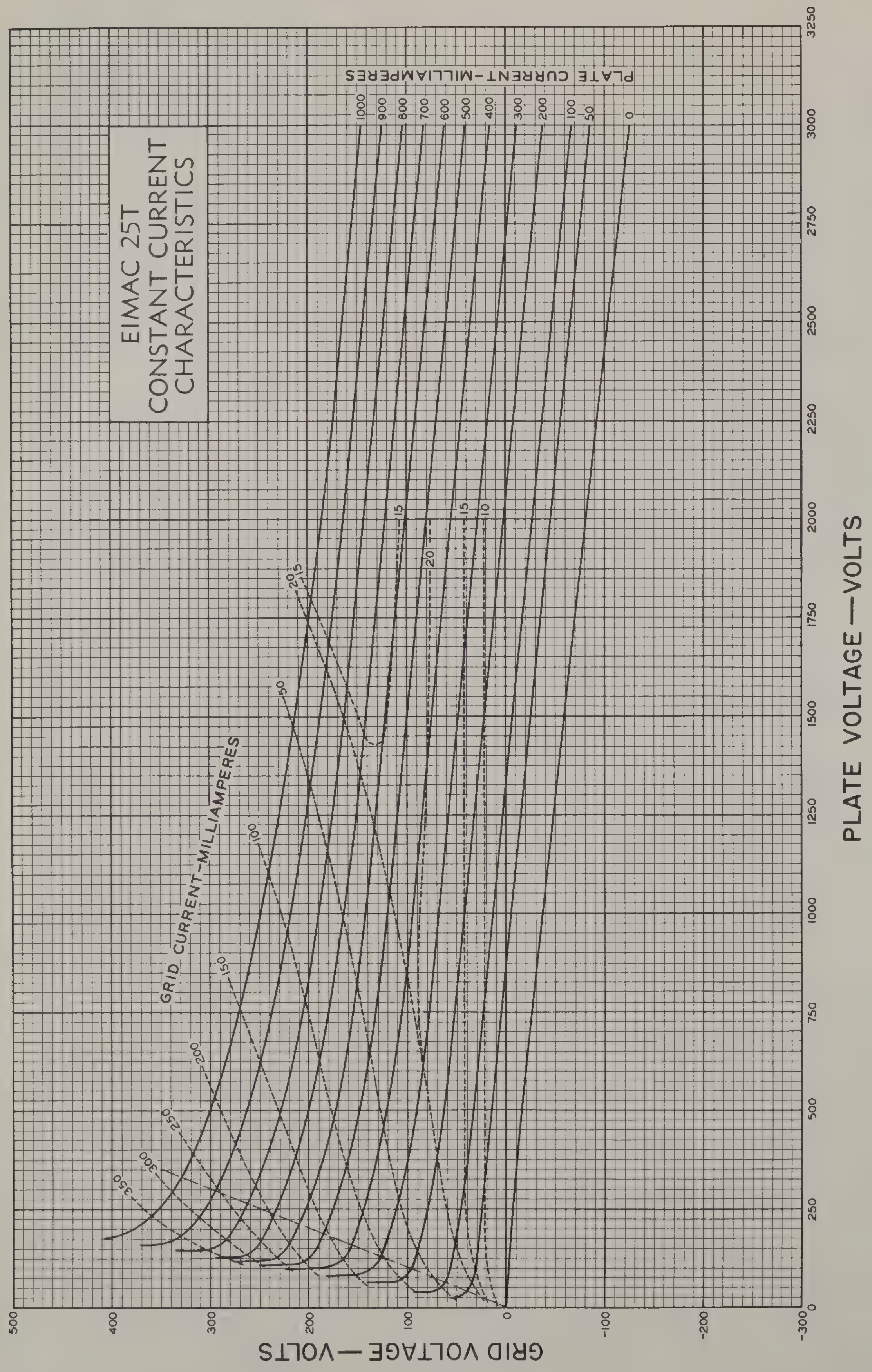
EIMAC 25T
CONSTANT CURRENT
CHARACTERISTICS
PLATE CURRENT–MILLIAMPERES
1000
900
800
700
600
500
400
300
200
100
50
0
GRID CURRENT–MILLIAMPERES
350
300
250
200
150
100
50
20
15
20
15
10
PLATE VOLTAGE — VOLTS
0
250
500
750
1000
1250
1500
1750
2000
2250
2500
2750
3000
3250
GRID VOLTAGE — VOLTS
500
400
300
200
100
0
-100
-200
-300

DRIVING POWER vs. POWER OUTPUT

•

The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 1000, 1500 and 2000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 1000, 1500, and 2000 volts respectively.

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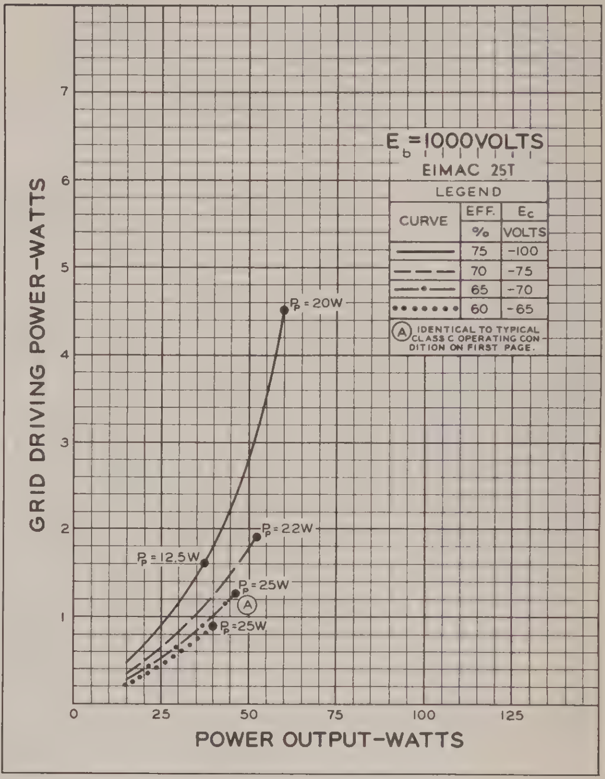
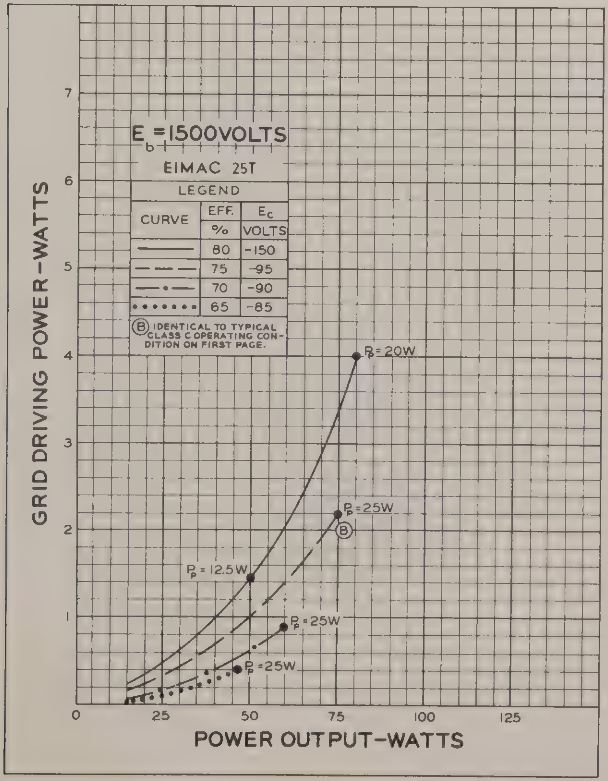
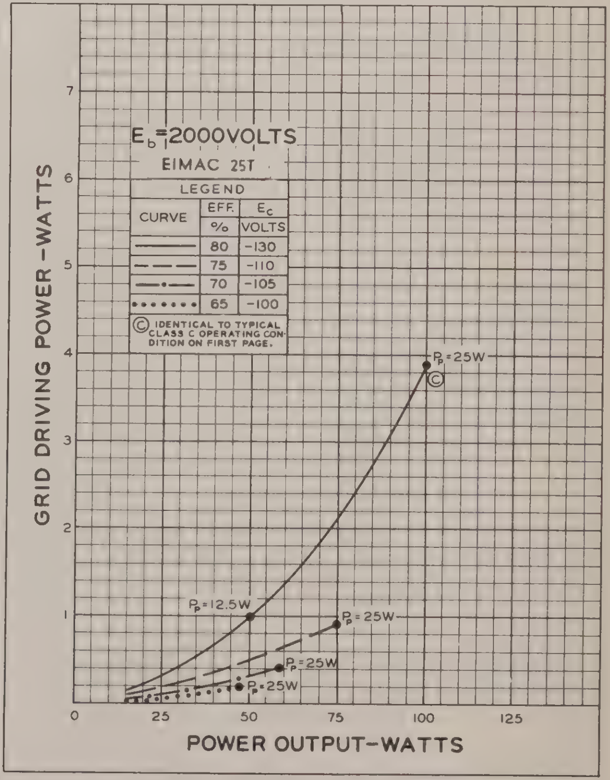
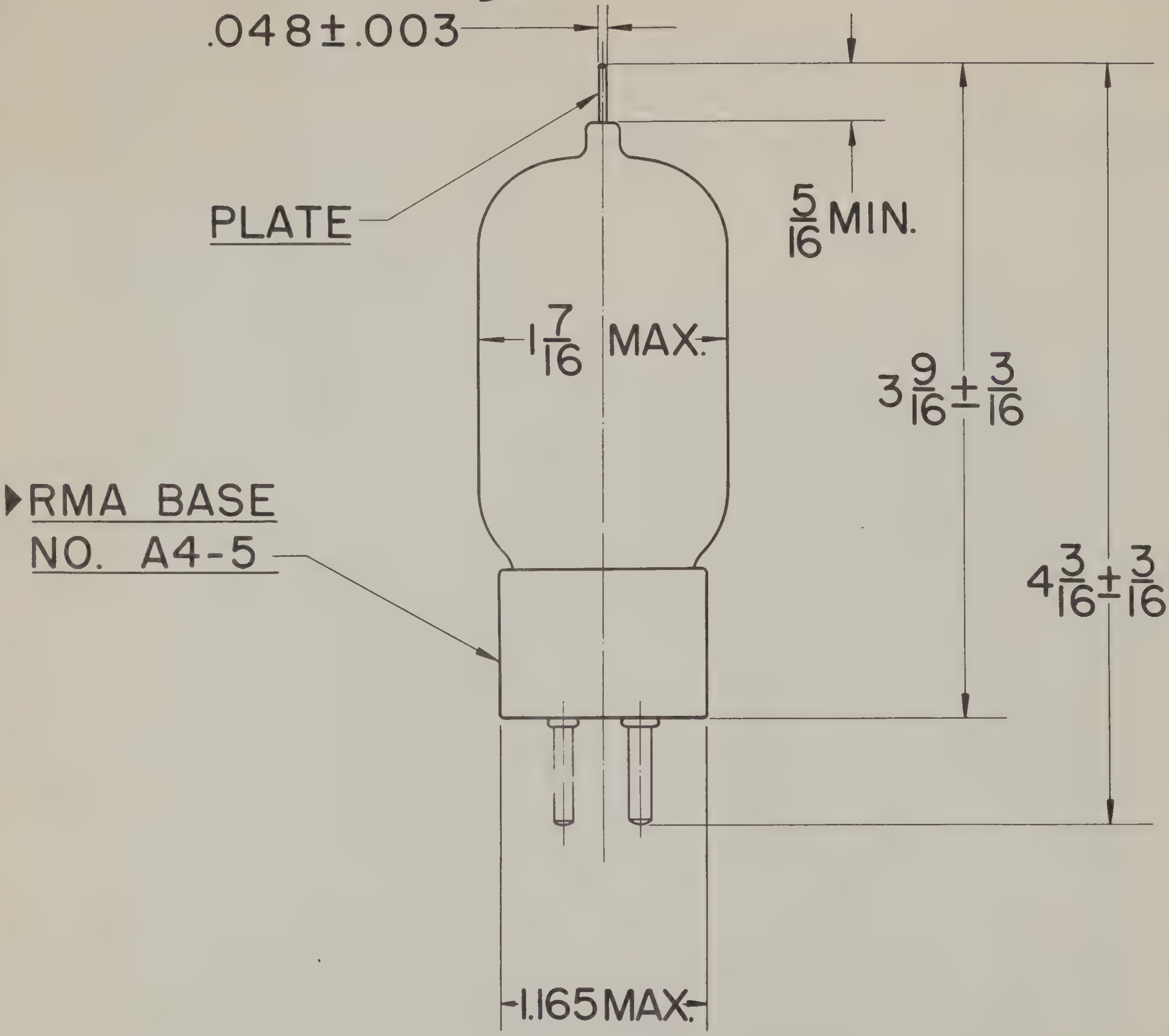


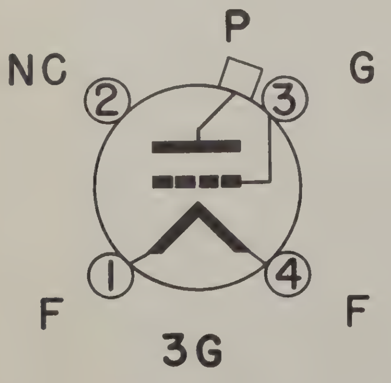


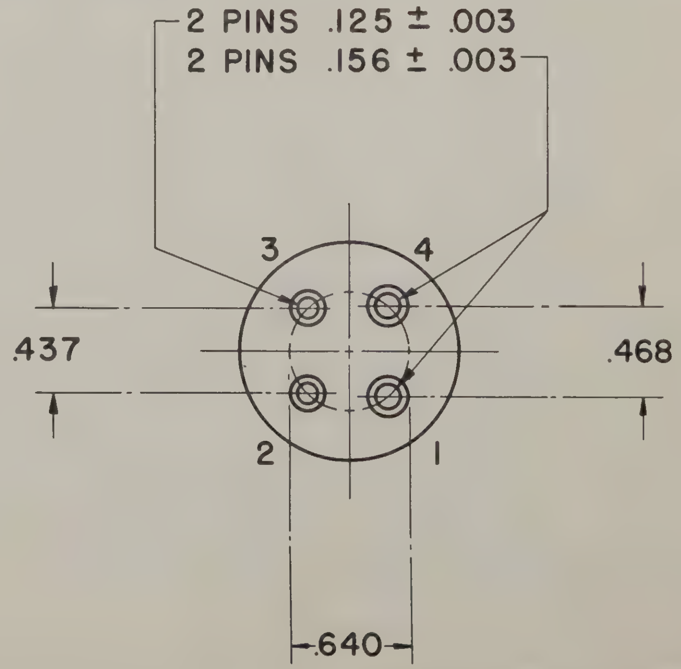


Eimac

25T







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▶ Indicates change from sheet dated 10-15-44.

EITEL-McCULLOUGH, INC.
SAN BRUNO · CALIFORNIA

35T

HIGH-MU TRIODE
MODULATOR
OSCILLATOR
AMPLIFIER

The Eimac 35T is a high-mu triode having a maximum plate dissipation of 50 watts. It is intended for use as an amplifier, oscillator or modulator, and can be used at its maximum ratings at frequencies up to 100 Mc.

The 35T is cooled by radiation and by free circulation of air around the envelope. The plate operates at a visible red color at full dissipation.

GENERAL CHARACTERISTICS

▶ ELECTRICAL

	Min.	Nom.	Max.	
Filament: Thoriated Tungsten				
Voltage		5.0		volts
Current	3.6		4.2	amperes
Amplification Factor	35		43	
Direct Interelectrode Capacitances:				
Grid-Plate	1.4		2.2	uuf
Grid-Filament	3.0		5.0	uuf
Plate-Filament	0.08		0.23	uuf
Transconductance (I_b=100 ma.)		2850		umhos
Frequency for Maximum Ratings			100	mc

MECHANICAL

Base: UX Medium 4-pin. Fits E. F. Johnson Co. 122-224, or National XC-4 or CIR-4 sockets.

Basing	See outline drawing
Mounting	Vertical, base down or up.
Cooling	Convection and radiation.
Recommended Heat-Dissipating Plate Connector	Eimac HR-3
Maximum Overall Dimensions:	
Length	5.5 inches
Diameter	1.8 inches
Net weight	2.5 ounces
Shipping weight (Average)	1.25 pounds

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class-AB$_2$ (Sinusoidal wave, two tubes unless otherwise specified)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	2000 MAX. VOLTS
D-C PLATE CURRENT	150 MAX. MA.
PLATE DISSIPATION	50 MAX. WATTS
GRID DISSIPATION	15 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	600	1000	1500	2000	Volts
D-C Grid Voltage (approx.)*	0	—8	—25	—40	Volts
Zero-signal D-C Plate Current	90	67	45	34	Ma.
Max-signal D-C Plate Current	300	240	200	167	Ma.
Effective Load Plate-to-Plate	4250	7900	16,200	27,500	Ohms
Peak A-F Input Voltage (per tube)	130	240	250	255	Volts
Peak Driving Power (approx.)	18	14	10	8	Watts
Nominal Driving Power (approx.)	9	7	5	4	Watts
Max-signal Plate Power Output	95	140	200	235	Watts

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony
(Key-down conditions, per tube)[1]

MAXIMUM RATINGS

D-C PLATE VOLTAGE	2000 MAX. VOLTS
D-C PLATE CURRENT	150 MAX. MA.
PLATE DISSIPATION	50 MAX. WATTS
GRID DISSIPATION	15 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	1000	1500	2000	Volts
D-C Grid Voltage	—60	—120	—135	Volts
D-C Plate Current	125	125	125	Ma.
D-C Grid Current	40	40	45	Ma.
Peak R-F Grid Input Voltage	165	250	285	Volts
Driving Power (approx.)	7	9	13	Watts
Grid Dissipation	4.2	5.0	6.8	Watts
Plate Power Input	125	188	250	Watts
Plate Dissipation	38	47	50	Watts
Plate Power Output	87	141	200	Watts

PLATE MODULATED RADIO FREQUENCY POWER AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)[1]

MAXIMUM RATINGS

D-C PLATE VOLTAGE	1600 MAX. VOLTS
D-C PLATE CURRENT	120 MAX. MA.
PLATE DISSIPATION	33 MAX. WATTS
GRID DISSIPATION	15 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	750	1000	1500	Volts
D-C Grid Voltage	—100	—125	—150	Volts
D-C Plate Current	95	100	90	Ma.
D-C Grid Current	40	40	40	Ma.
Peak R-F Driving Voltage (approx.)	210	240	270	Volts
Driving Power (approx.)	9	10	11	Watts
Plate Dissipation	20	25	30	Watts
Plate Input	70	100	135	Watts
Plate Power Output	50	75	105	Watts

*Adjust for stated zero-signal plate current.

[1] The performance figures listed under Typical Operation are for radio frequencies up to the VHF region and are obtained by calculation from the characteristic tube curves and confirmed by direct tests. The driving power given includes power taken by the tube grid and the bias circuit. The driving power and output power do not allow for losses in the associated resonant circuits. These losses are not included because they depend principally upon the design and choice of the circuit components.

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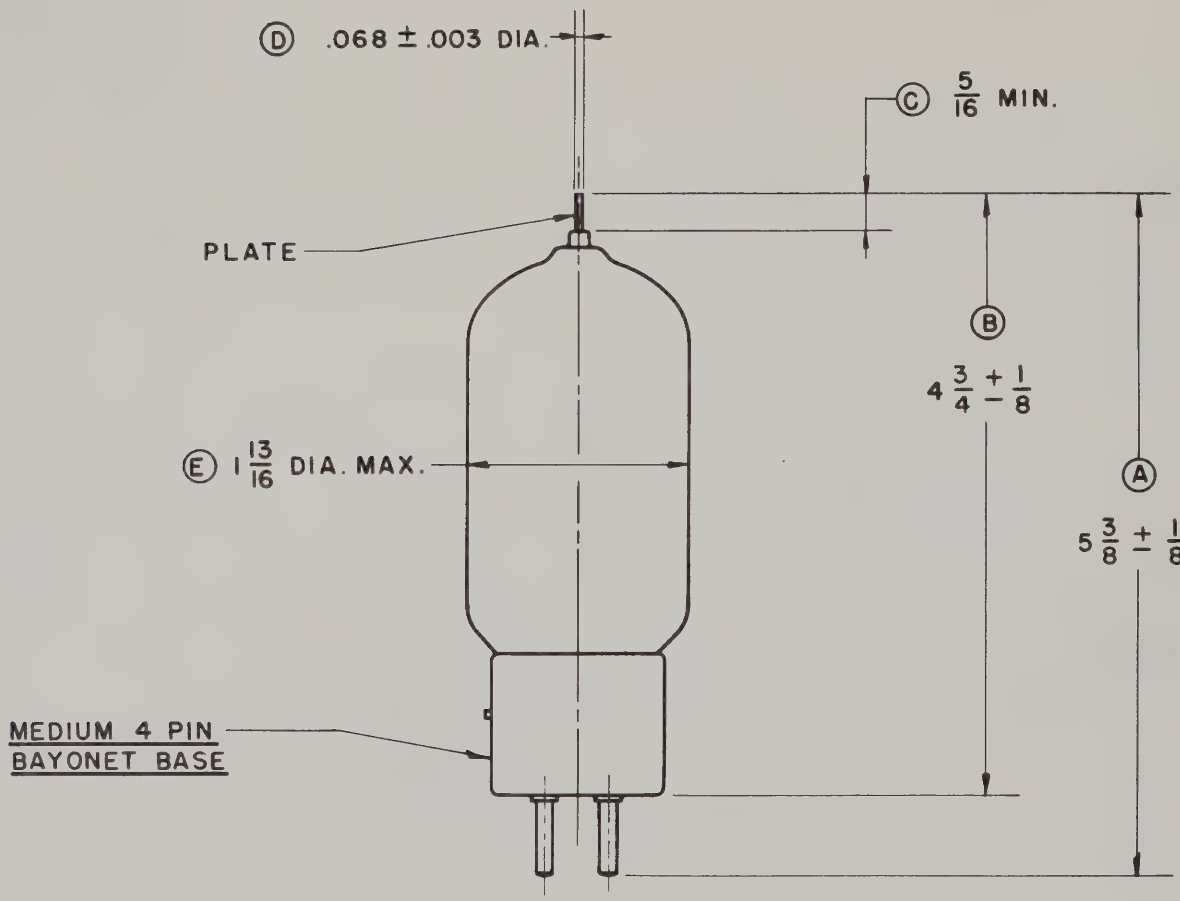
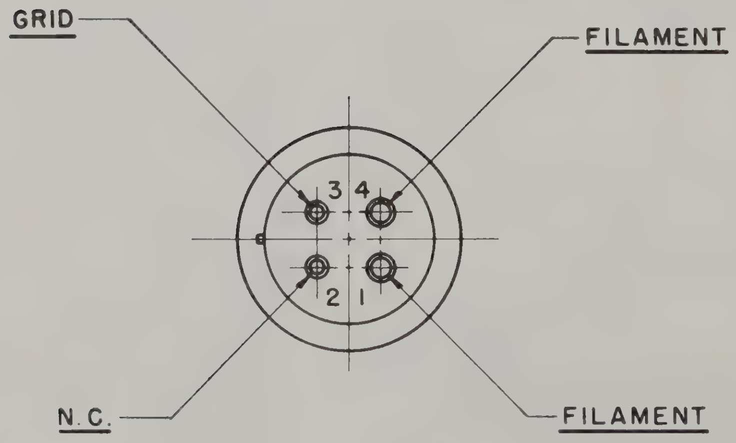
▶ Indicates change from sheet dated 6-15-51.

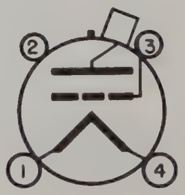




DESIGN TEST MEASUREMENTS: A, E,

TYPE APPROVAL MEASUREMENTS: B, D,

PRODUCTION TEST MEASUREMENTS: C,



DRIVING POWER vs. POWER OUTPUT

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The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 1000, 1500 and 2000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 1000, 1500, and 2000 volts respectively.

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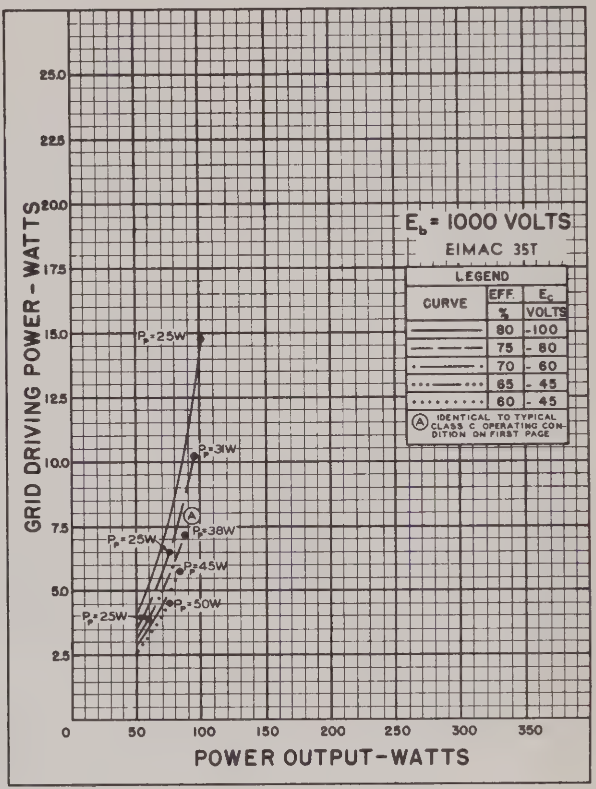
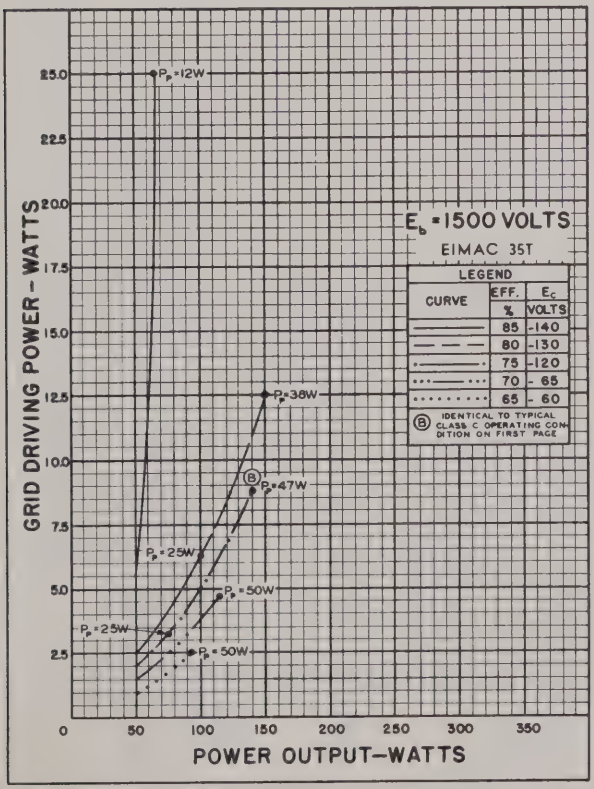
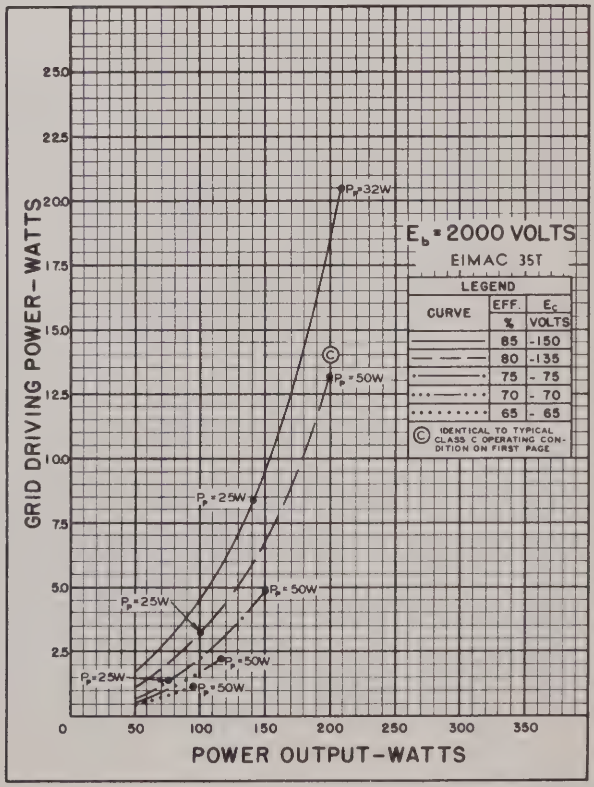
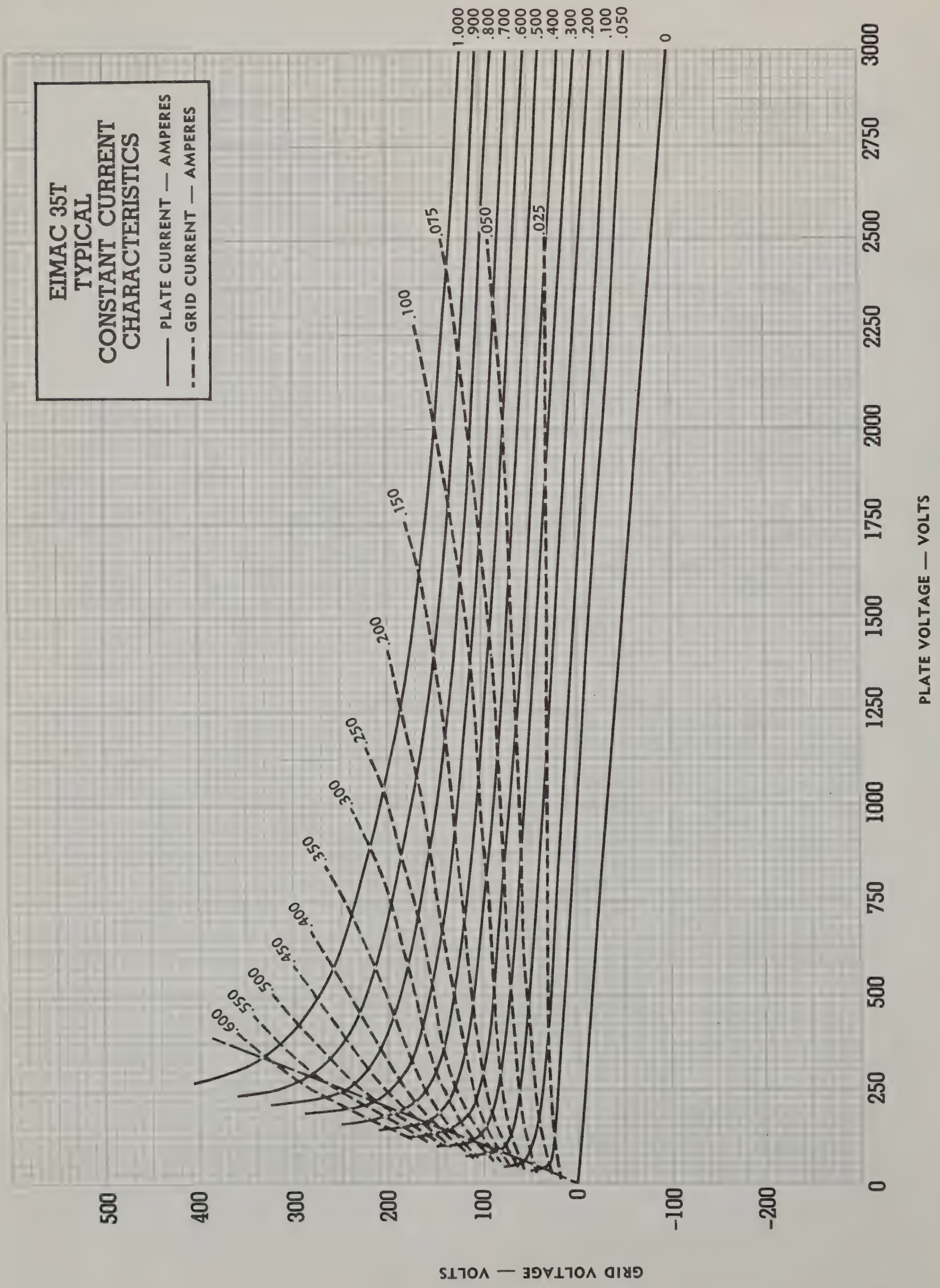







EIMAC 35T
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
PLATE CURRENT — AMPERES
GRID CURRENT — AMPERES
1.000
.900
.800
.700
.600
.500
.400
.300
.200
.100
.050
0
.075
.050
.025
.100
.150
.200
.250
.300
.350
.400
.450
.500
.550
.600
PLATE VOLTAGE — VOLTS
0
250
500
750
1000
1250
1500
1750
2000
2250
2500
2750
3000
GRID VOLTAGE — VOLTS
500
400
300
200
100
0
-100
-200

Eimac®

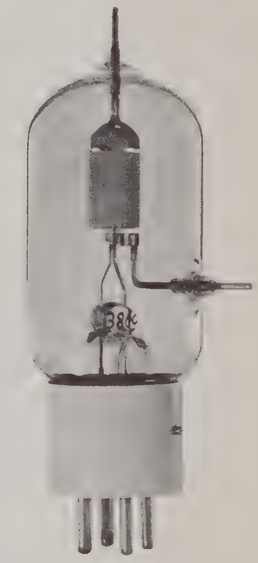
EITEL-McCULLOUGH, INC.
SAN CARLOS · CALIFORNIA

35TG

HIGH-MU TRIODE
•
MODULATOR
OSCILLATOR
AMPLIFIER

▶ The Eimac 35TG is a high-mu triode having a maximum plate dissipation of 50 watts. It is intended for use as an amplifier, oscillator or modulator, and can be used at its maximum ratings at frequencies up to 100 Mc. It is basically the same as the Eimac 35T except that the grid terminal is located at the side of the bulb.

The 35TG is cooled by radiation and by free circulation of air around the envelope.



GENERAL CHARACTERISTICS

▶ ELECTRICAL

Filament: Thoriated Tungsten	Min.	Nom.	Max.	
Voltage		5.0		volts
Current	3.6		4.2	amperes
Amplification Factor	35		43	
Direct Interelectrode Capacitances:				
Grid-Plate	1.25		2.05	uuf
Grid-Filament	2.00		3.20	uuf
Plate-Filament	0.10		0.35	uuf
Transconductance (I_b=100 ma.)		2850		umhos
Frequency for Maximum Ratings			100	mc

MECHANICAL

Base: UX Medium 4-pin. Fits E. F. Johnson Co. 122-224, or National XC-4 or CIR-4 sockets.

Basing	See outline drawing
Mounting	Vertical, base down or up.
Cooling	Convection and radiation.
Recommended Heat Dissipating Plate Connector	Eimac HR-3
Maximum Overall Dimensions:	
Length	5.5 inches
Diameter	1.8 inches
Net weight	2.5 ounces
Shipping weight (Average)	1.25 pounds

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class-AB₂ (Sinusoidal wave, two tubes unless otherwise specified)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	2000 MAX. VOLTS
D-C PLATE CURRENT	150 MAX. MA.
PLATE DISSIPATION	50 MAX. WATTS
GRID DISSIPATION	15 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	600	1000	1500	2000	volts
D-C Grid Voltage (approx.)*	0	—8	—25	—40	volts
Zero-signal D-C Plate Current	90	67	45	34	ma
Max-signal D-C Plate Current	300	240	200	167	ma
Effective Load Plate-to-Plate	4250	7900	16,200	27,500	ohms
Peak A-F Input Voltage (per tube)	130	240	250	255	volts
Peak Driving Power (approx.)	18	14	10	8	watts
Nominal Driving Power (approx.)	9	7	5	4	watts
Max-signal Plate Power Output	95	140	200	235	watts

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony
(Key-down conditions, per tube)[1]

MAXIMUM RATINGS

D-C PLATE VOLTAGE	2000 MAX. VOLTS
D-C PLATE CURRENT	150 MAX. MA.
PLATE DISSIPATION	50 MAX. WATTS
GRID DISSIPATION	15 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	1000	1500	2000	volts
D-C Grid Voltage	—60	—120	—135	volts
D-C Plate Current	125	125	125	ma
D-C Grid Current	40	40	45	ma
Peak R-F Grid Input Voltage	165	250	285	volts
Driving Power (approx.)	7	9	13	watts
Grid Dissipation	4.2	5.0	6.8	watts
Plate Power Input	125	188	250	watts
Plate Dissipation	38	47	50	watts
Plate Power Output	87	141	200	watts

PLATE MODULATED RADIO FREQUENCY POWER AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)[1]

MAXIMUM RATINGS

D-C PLATE VOLTAGE	1600 MAX. VOLTS
D-C PLATE CURRENT	120 MAX. MA.
PLATE DISSIPATION	33 MAX. WATTS
GRID DISSIPATION	15 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	750	1000	1500	volts
D-C Grid Voltage	—100	—125	—150	volts
D-C Plate Current	95	100	90	ma
D-C Grid Current	40	40	40	ma
Peak R-F Driving Voltage (approx.)	210	240	270	volts
Driving Power (approx.)	9	10	11	watts
Plate Dissipation	20	25	30	watts
Plate Input	70	100	135	watts
Plate Power Output	50	75	105	watts

*Adjust for stated zero-signal plate current.

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[1] The performance figures listed under Typical Operation are for radio frequencies up to the VHF region and are obtained by calculation from the characteristic tube curves and confirmed by direct tests. The driving power given includes power taken by the tube grid and the bias circuit. The driving power and output power do not allow for losses in the associated resonant circuits. These losses are not included because they depend principally upon the design and choice of the circuit components.

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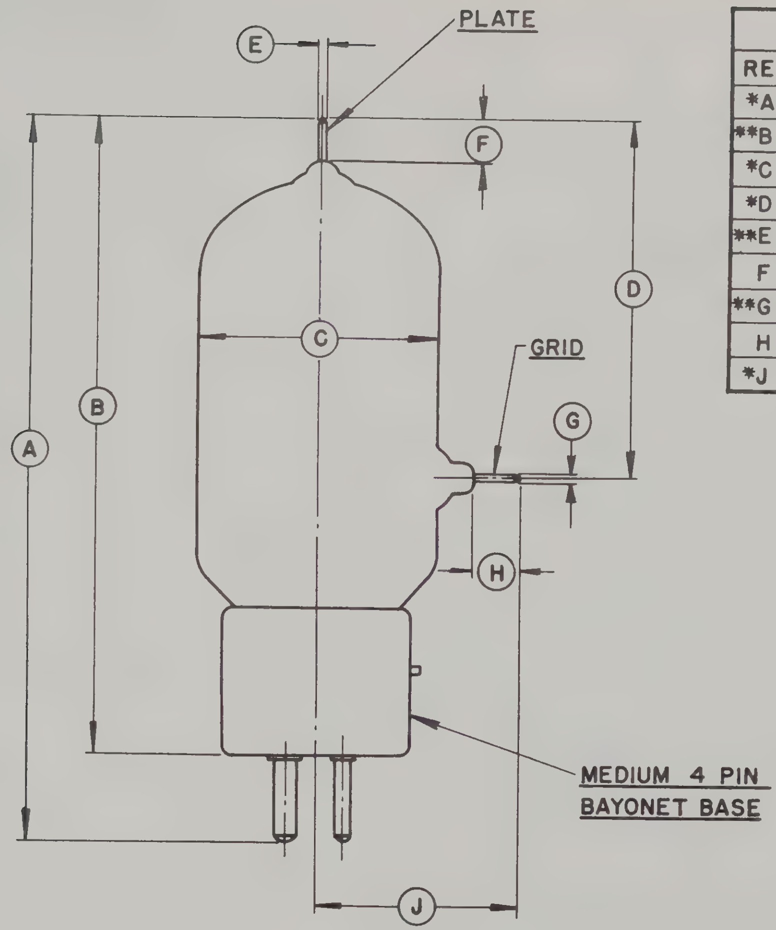
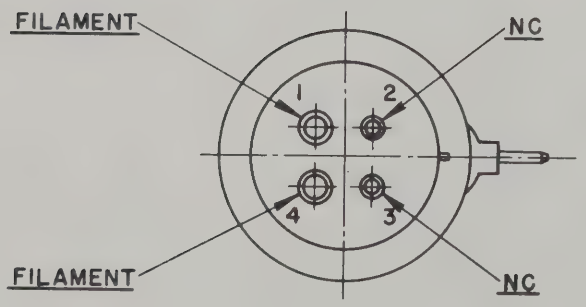
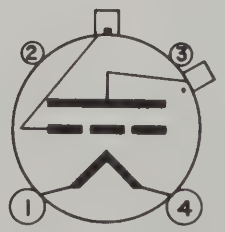
▶ Indicates change from sheet dated 10-1-51

▶



DIMENSION DATA			
REF.	NOM.	MIN.	MAX.
*A		5 3/8	5 3/4
**B		4 3/4	5 1/8
*C			1.813
*D		2.060	2.680
**E		.065	.071
F		.312	
**G		.065	.071
H		.312	
*J		1.370	1.630





NOTES:

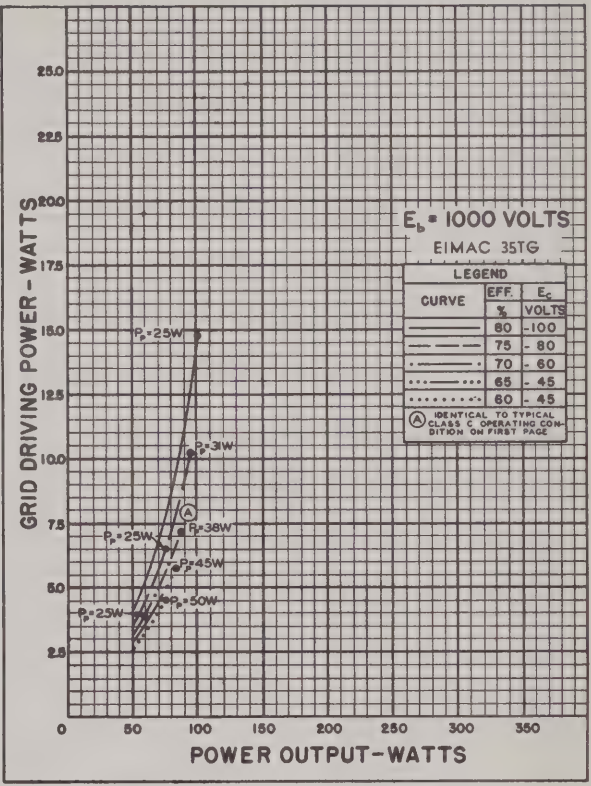
1. DIMENSIONS IN INCHES.
2. *STANDARD DESIGN TESTS & QUALIFICATION TESTS.
3. **QUALIFICATION TESTS.

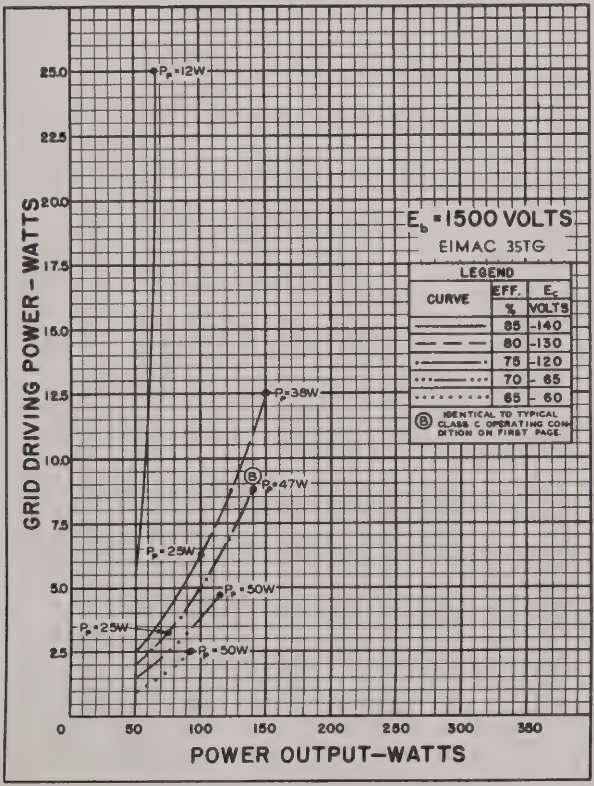
▶ Indicates change from sheet dated 10-1-51

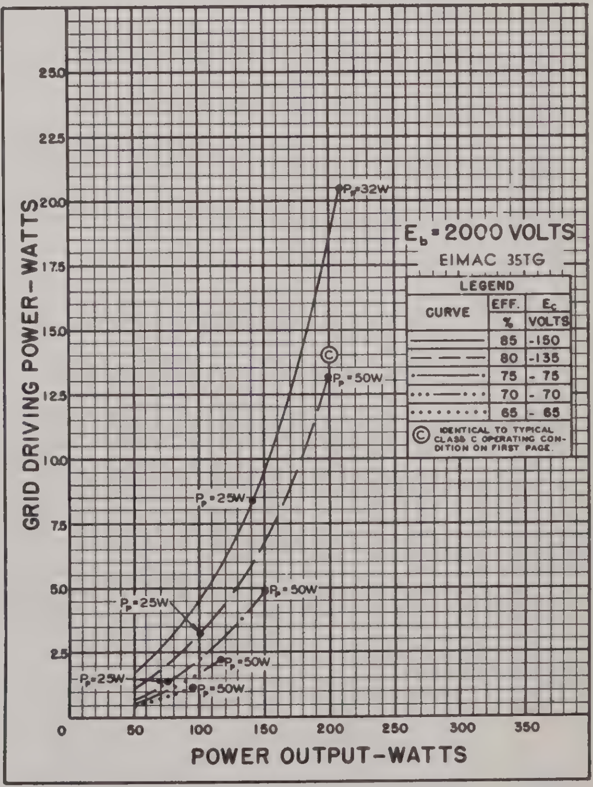
DRIVING POWER vs. POWER OUTPUT

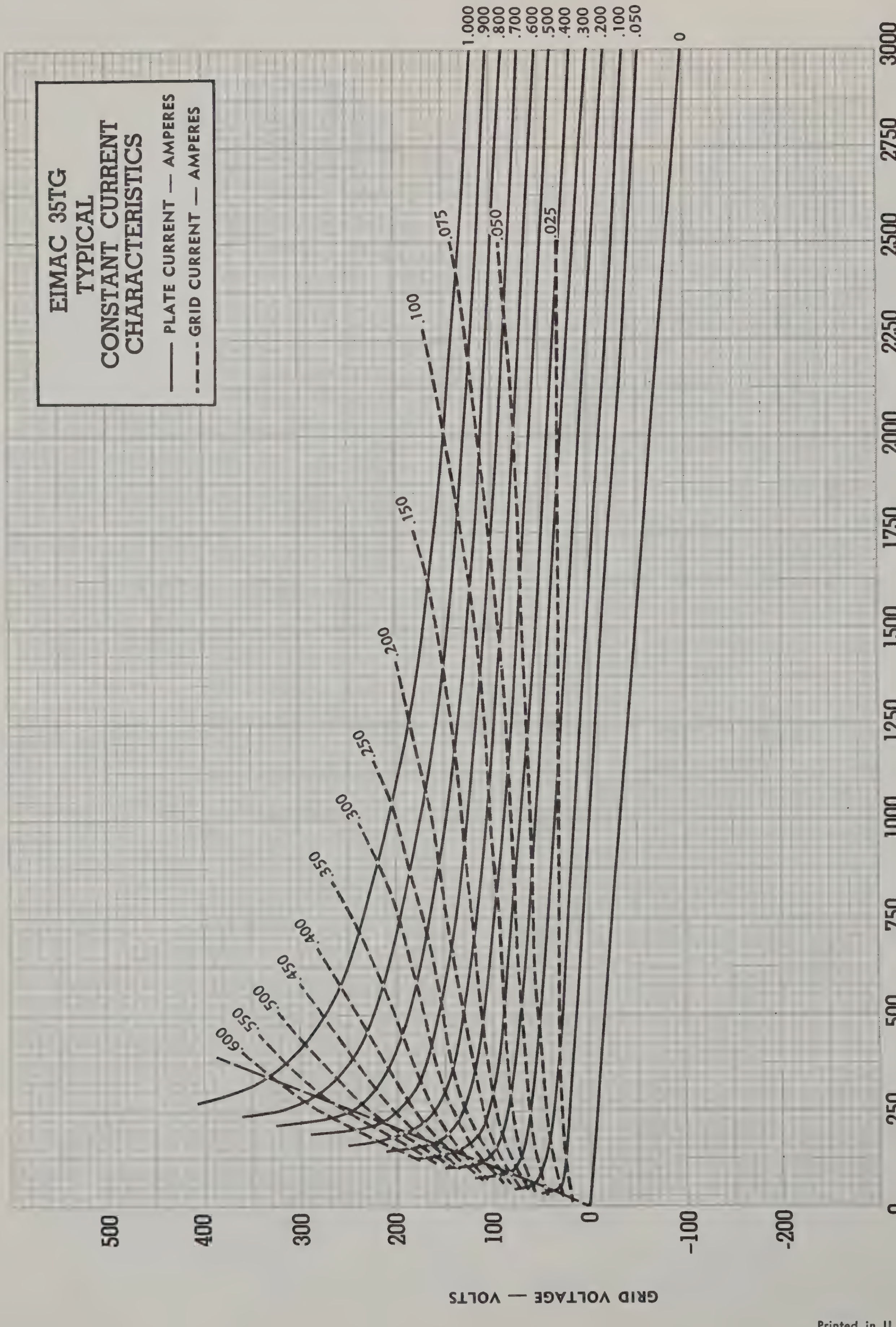
The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 1000, 1500 and 2000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 1000, 1500, and 2000 volts respectively.









Printed in U.S.A. 54405

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

75TH

MEDIUM-MU TRIODE
•
MODULATOR
OSCILLATOR
AMPLIFIER

▶ The Eimac 75TH is a medium-mu power triode intended for use as an amplifier, oscillator, or modulator. It has a maximum plate dissipation rating of 75 watts and a maximum plate voltage rating of 3000 volts at frequencies up to 40 Mc. Forced-air cooling is not required in properly designed equipment operating at frequencies below 40 Mc.

The 75TH in Class-C R-F service will deliver up to 225 watts plate power output with 10 watts driving power. Two 75TH's in Class-B modulator service will deliver up to 300 watts maximum-signal plate power output with 3 watts driving power.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten	
Voltage	5.0 volts
Current	6.25 amperes
Amplification Factor (Average)	20
Direct Interelectrode Capacitances (Average)	
Grid-Plate	2.3 $\mu\mu$f
Grid-Filament	2.7 $\mu\mu$f
Plate-Filament	0.3 $\mu\mu$f
Transconductance (I_b=225 ma., E_b=3000 v.)	4150 μmhos
▶ Highest Frequency for Maximum Ratings	40 Mc

▶ MECHANICAL

Base	Medium 4-pin bayonet
Basing	See outline drawing
Socket	Johnson type No. 122-224, National type No. XC-4 or CIR-4, or equivalent
Mounting Position	Vertical, base down or up
Cooling	Convection and radiation
Maximum Temperature of Plate and Grid Seals	225°C
Recommended Heat Dissipating Connectors:	
Plate	Eimac HR-3
Grid	Eimac HR-2
Maximum Overall Dimensions:	
Length	7.25 inches
Diameter	2.81 inches
Net Weight	3 ounces
Shipping Weight (Average)	1.5 pounds

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy (Key-down conditions, 1 tube)

MAXIMUM RATINGS (Frequencies up to 40 Mc.)

D-C PLATE VOLTAGE	3000 MAX. VOLTS
D-C PLATE CURRENT	225 MAX. MA.
PLATE DISSIPATION	75 MAX. WATTS
GRID DISSIPATION	16 MAX. WATTS

TYPICAL OPERATION (Frequencies up to 40 Mc.)

D-C Plate Voltage	1000	1500	2000	volts
D-C Grid Voltage	—80	—125	—200	volts
D-C Plate Current	215	167	150	ma.
▶ D-C Grid Current (approx.)	35	23	32	ma.
▶ Peak R-F Grid Input Voltage (approx.)	270	280	350	volts
Driving Power (approx.)	9	6	10	watts
Plate Power Input	215	250	300	watts
Plate Dissipation	75	75	75	watts
Plate Power Output	140	175	225	watts

▶ PLATE MODULATED RADIO FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS (Frequencies up to 40 Mc.)

D-C PLATE VOLTAGE	2400 MAX. VOLTS
D-C PLATE CURRENT	180 MAX. MA.
PLATE DISSIPATION	50 MAX. WATTS
GRID DISSIPATION	16 MAX. WATTS

TYPICAL OPERATION (Frequencies up to 40 Mc.)

D-C Plate Voltage	1000	1500	2000	volts
D-C Grid Voltage	—150	—200	—300	volts
D-C Plate Current	135	115	110	ma.
D-C Grid Current (approx.)	20	14	15	ma.
Peak R-F Grid Input Voltage (approx.)	300	330	440	volts
Driving Power (approx.)	6	5	6	watts
Grid Dissipation	3	2	2	watts
Plate Power Input	135	175	220	watts
Plate Dissipation	50	50	50	watts
Plate Power Output	85	125	170	watts

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class-B

MAXIMUM RATINGS (Per tube)

D-C PLATE VOLTAGE	3000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT	225 MAX. MA.
PLATE DISSIPATION	75 MAX. WATTS
GRID DISSIPATION	16 MAX. WATTS

TYPICAL OPERATION (Sinusoidal wave, two tubes unless otherwise specified)

D-C Plate Voltage	1000	1500	2000	volts
▶ D-C Grid Voltage (approx.)[1]	—30	—60	—90	volts
Zero-Signal D-C Plate Current	90	67	50	ma.
Max-Signal D-C Plate Current	350	267	225	ma.
Effective Load, Plate-to-Plate	5300	11,400	19,300	ohms
Peak A-F Grid Input Voltage (per tube)	175	165	175	volts
Max-Signal Driving Power (approx.)	7	4	3	watts
Max-Signal Plate Dissipation (per tube)	75	75	75	watts
Max-Signal Plate Power Output	200	250	300	watts
▶ Total Harmonic Distortion	1.5	2.0	2.0	per cent

[1] Adjust to give stated zero-signal plate current.

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER "TYPICAL OPERATION", POSSIBLY EXCEEDING MAXIMUM RATINGS, WRITE EITEL-McCULLOUGH, INC., FOR INFORMATION AND RECOMMENDATIONS.

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▶ Indicates change from sheet dated 7-1-44.

APPLICATION

▶ MECHANICAL

Mounting—The 75TH must be mounted vertically, base down or up. The plate and grid leads should be flexible. The tube must be protected from vibration and shock.

Cooling—Heat Dissipating Connectors (Eimac HR-3 and HR-2) should be used at the plate and grid terminals of the 75TH. If the free circulation of air around the tube is restricted, a small fan or centrifugal blower should be used to provide additional cooling for the plate and grid seals.

Cooling requirements will be met if the temperature of the plate and grid seals is not allowed to exceed 225°C. One method of measuring these temperatures is provided by the use of "Tempilaq", a temperature-sensitive lacquer available from the Tempil Corporation, New York 11, N.Y.

ELECTRICAL

▶ **Filament Voltage**—For maximum tube life the filament voltage, as measured directly at the base pins, should be the rated value of 5.0 volts. Variations must be kept within the range of 4.75 to 5.25 volts.

Bias Voltage—Although there is no maximum limit on the bias voltage which may be used on the 75TH, there is little advantage in using bias voltages in excess of those given under "Typical Operation," except in certain very specialized applications. Where bias is obtained by a grid leak, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation.

Plate Voltage—The plate-supply voltage for the 75TH should not exceed 3000 volts. In most cases there is little advantage in using plate-supply voltages higher than those given under "Typical Operation" for the power output desired.

Grid Dissipation—The power dissipated by the grid of the 75TH must not exceed 16 watts. Grid dissipation may be calculated from the following expression:

$$P_g = e_{cmp} I_c$$

where P_g = Grid dissipation,

e_{cmp} = Peak positive grid voltage, and

I_c = D-c grid current.

e_{cmp} may be measured by means of a suitable peak voltmeter connected between filament and grid[1]. In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading.

▶ **Plate Dissipation**—The plate of the 75TH operates at a visibly red temperature at its maximum rated dissipation of 75 watts. Plate dissipation in excess of the maximum rating is permissible only for short periods of time, such as during tuning procedures.

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[1] For suitable peak v.t.v.m. circuits see, for instance, "Vacuum Tube Ratings", **Eimac News**, January, 1945. This article is available in reprint form on request.

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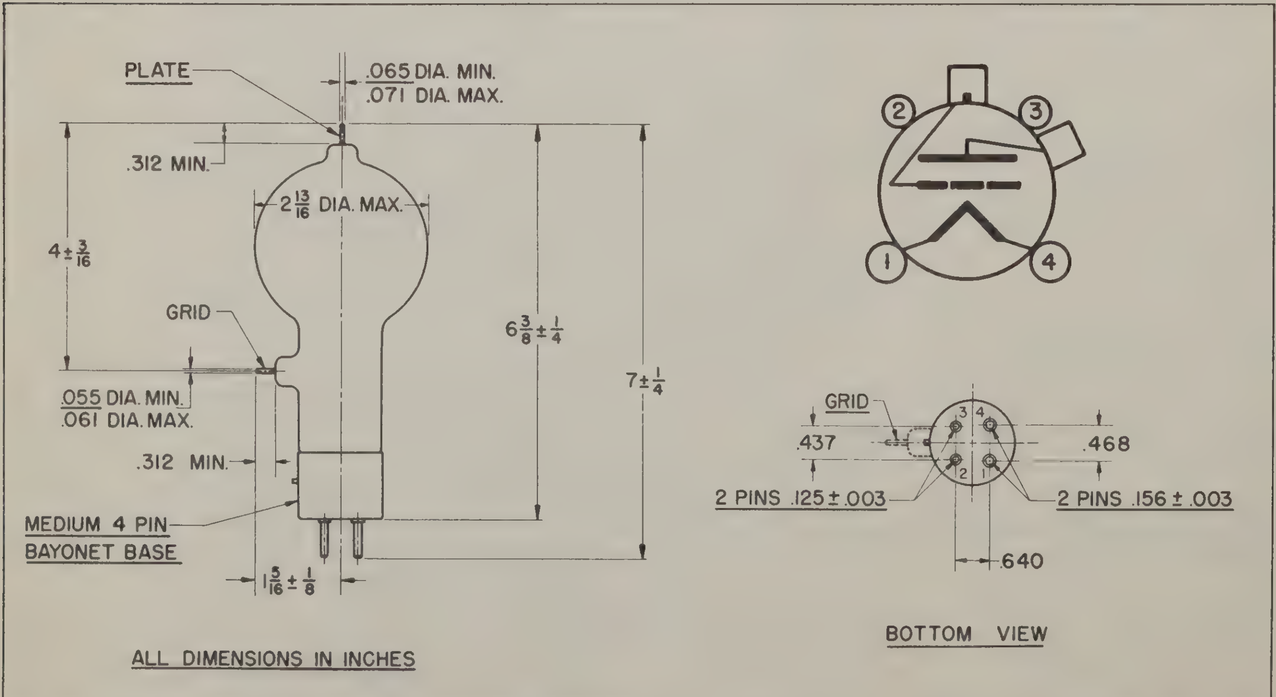

▶ Indicates change from sheet dated 7-1-44.

DRIVING POWER vs. POWER OUTPUT

•

The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 1000, 1500 and 2000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 1000, 1500, and 2000 volts respectively.

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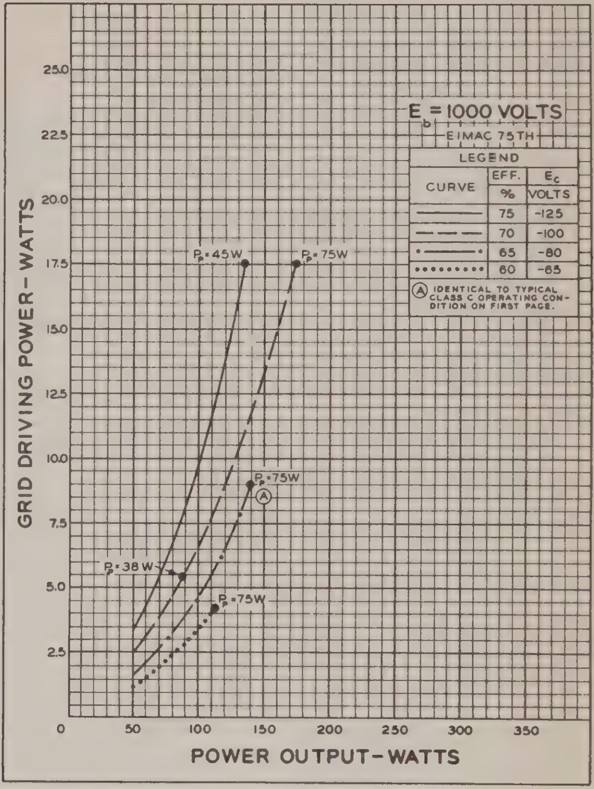
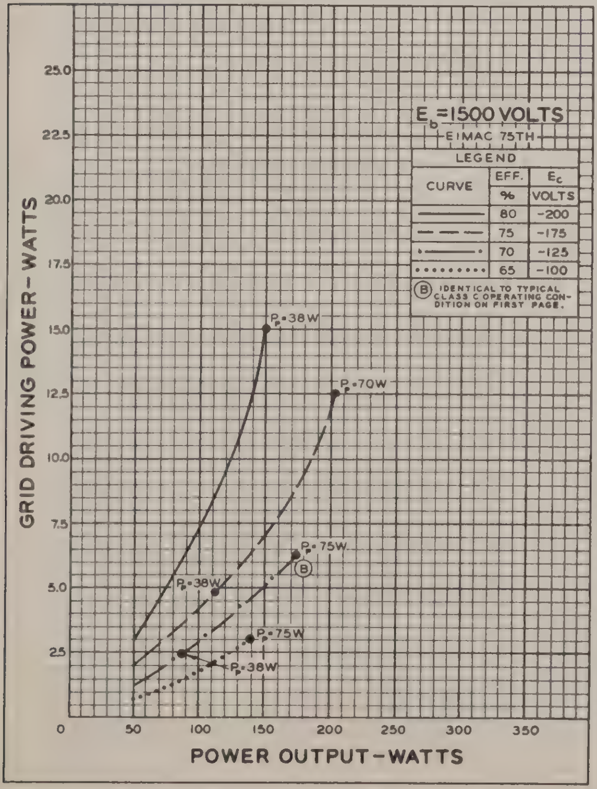
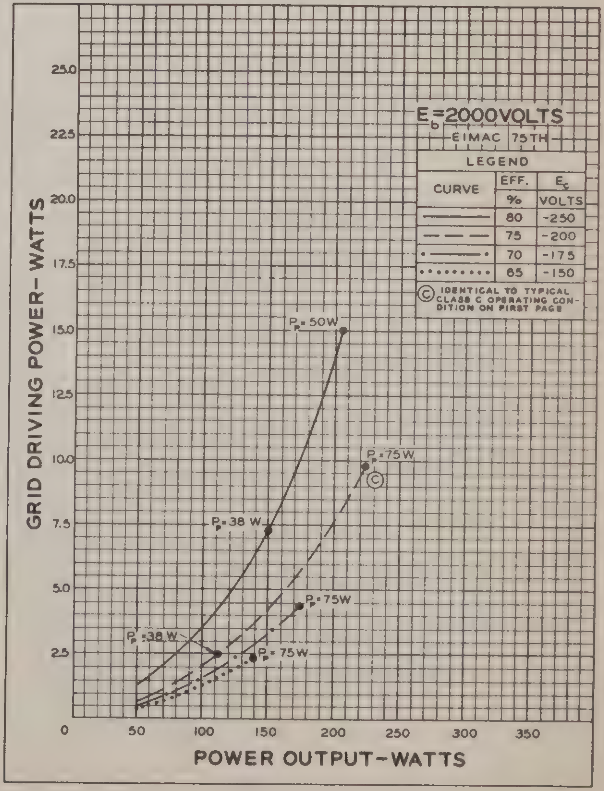
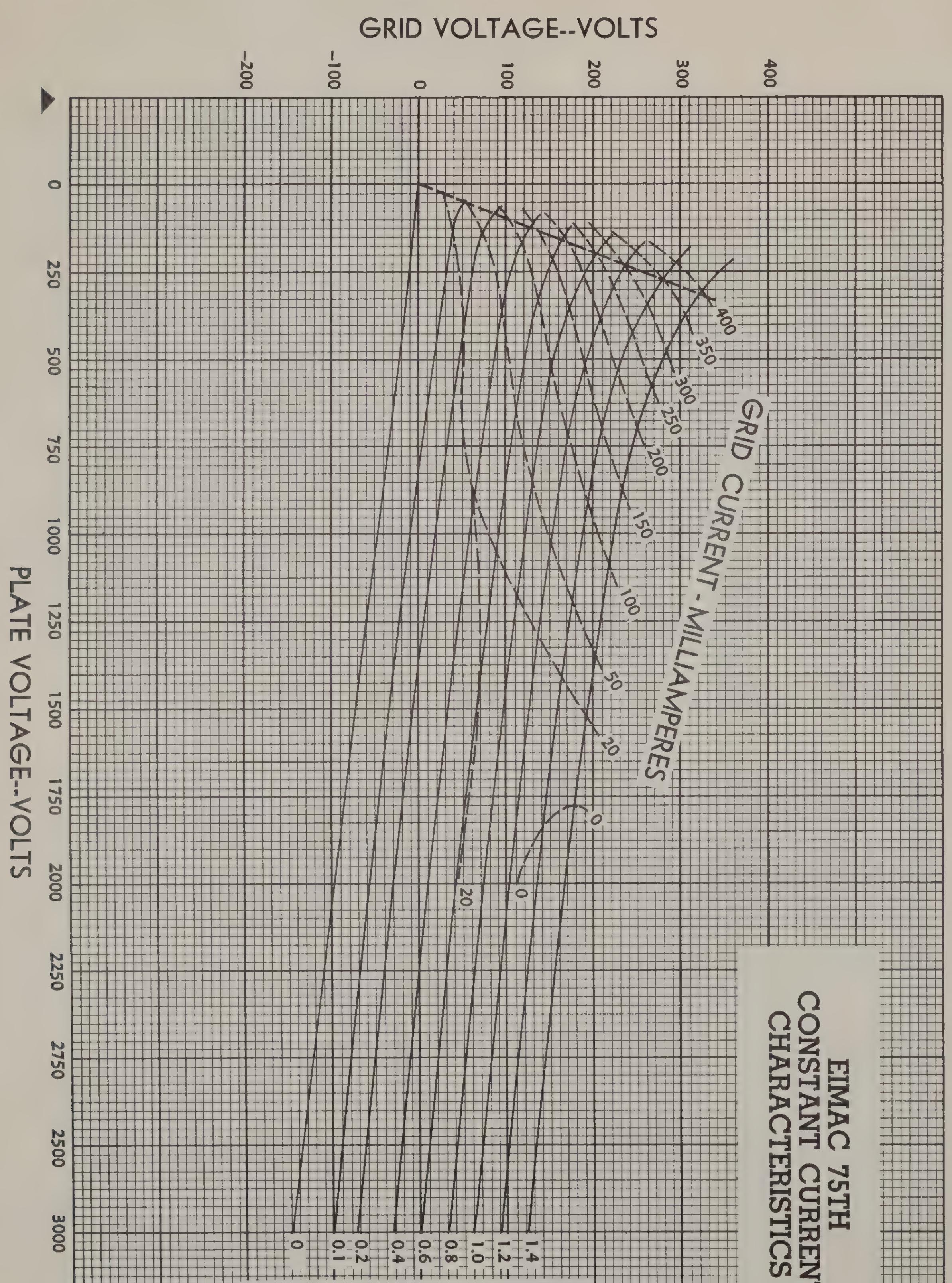








EIMAC 75TH
CONSTANT CURRENT
CHARACTERISTICS

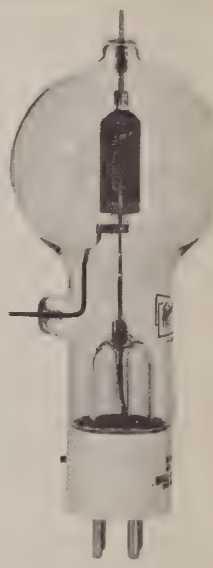
Indicates change from sheet dated 7-1-44.

PRINTED IN U. S. A. 5-G1-76230

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

75TL

LOW-MU TRIODE
•
MODULATOR
OSCILLATOR
AMPLIFIER



▶ The Eimac 75TL is a low-mu power triode intended for use as an amplifier, oscillator, or modulator. It has a maximum plate dissipation rating of 75 watts and a maximum plate voltage rating of 3000 volts at frequencies up to 40 Mc. Forced-air cooling is not required in properly designed equipment operating at frequencies below 40 Mc.

The 75TL in Class-C R-F service will deliver up to 225 watts plate power output with 8 watts driving power. Two 75TL's in Class-B modulator service will deliver up to 350 watts maximum-signal plate power output with 5 watts driving power.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated tungsten	
Voltage	5.0 volts
Current	6.25 amperes
Amplification Factor (Average)	12
Direct Interelectrode Capacitances (Average)	
Grid-Plate	2.4 μμf
Grid-Filament	2.6 μμf
Plate-Filament	0.4 μμf
Transconductance (I_b=225 ma., E_b=2500v.)	3350 μmhos
Highest Frequency for Maximum Ratings	40 Mc.

MECHANICAL

Base	Medium 4-pin bayonet
Basing	See outline drawing
Socket	Johnson type No. 122-224, National type No. XC-4 or CIR-4, or equivalent
Mounting Position	Vertical, base down or up
Cooling	Convection and radiation
Maximum Temperature of Plate and Grid Seals	225°C
Recommended Heat Dissipating Connectors:	
Plate	Eimac HR-3
Grid	Eimac HR-2
Maximum Overall Dimensions:	
Length	7.25 inches
Diameter	2.81 inches
Net Weight	3 ounces
Shipping Weight (Average)	1.5 pounds

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy (Key-down conditions, 1 tube)

MAXIMUM RATINGS (Frequencies up to 40 Mc.)

D-C PLATE VOLTAGE	3000 MAX. VOLTS
D-C PLATE CURRENT	225 MAX. MA.
PLATE DISSIPATION	75 MAX. WATTS
GRID DISSIPATION	13 MAX. WATTS

TYPICAL OPERATION (Frequencies up to 40 Mc.)

D-C Plate Voltage	1000	1500	2000	volts
D-C Grid Voltage	—150	—250	—300	volts
D-C Plate Current	215	167	150	ma.
D-C Grid Current	28	22	21	ma.
Peak R-F Grid Input Voltage (approx.)	320	355	425	volts
Driving Power (approx.)	8	6	8	watts
Plate Power Input	215	250	300	watts
Plate Dissipation	75	75	75	watts
Plate Power Output	140	175	225	watts

▶ PLATE MODULATED RADIO FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS (Frequencies up to 40 Mc.)

D-C PLATE VOLTAGE	2400 MAX. VOLTS
D-C PLATE CURRENT	180 MAX. MA.
PLATE DISSIPATION	50 MAX. WATTS
GRID DISSIPATION	16 MAX. WATTS

TYPICAL OPERATION (Frequencies up to 40 Mc.)

D-C Plate Voltage	1000	1500	2000	volts
Total Bias Voltage	—250	—370	—500	volts
Fixed Bias Voltage	—130	—260	—380	volts
Grid Resistor	7500	6000	6000	ohms
D-C Plate Current	135	130	130	ma.
D-C Grid Current (approx.)	16	18	20	ma.
Peak R-F Grid Input Voltage (approx.)	410	545	695	volts
Driving Power (approx.)	6	10	14	watts
Grid Dissipation	2	3	4	watts
Plate Power Input	135	195	260	watts
Plate Dissipation	50	50	50	watts
Plate Power Output	85	145	210	watts

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class—AB_1

MAXIMUM RATINGS (Per tube)

D-C PLATE VOLTAGE	3000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT	225 MAX. MA.
PLATE DISSIPATION	75 MAX. WATTS

▶ TYPICAL OPERATION (Sinusoidal wave, two tubes unless otherwise specified)

D-C Plate Voltage	1500	2000	volts
D-C Grid Voltage[1]	—130	—190	volts
Peak A-F Grid Input Voltage (per tube)	130	190	volts
Zero-Signal D-C Plate Current	67	50	ma.
Max-Signal D-C Plate Current	143	130	ma.
Driving Power	0	0	watt
Effective Load, Plate-to-Plate	10,200	21,200	ohms
Max-Signal Plate Power Output	64	110	watts
Max-Signal Plate Dissipation (per tube)	75	75	watts
Total Harmonic Distortion	3.0	3.5	per cent

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER "TYPICAL OPERATION", POSSIBLY EXCEEDING MAXIMUM RATINGS, WRITE EITEL-McCULLOUGH, INC., FOR INFORMATION AND RECOMMENDATIONS.

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▶ Indicates change from sheet dated 4-1-46.

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class—AB$_2$

MAXIMUM RATINGS (Per tube)

D-C PLATE VOLTAGE - - - - - -	3000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT - -	225 MAX. MA.
PLATE DISSIPATION - - - - - -	75 MAX. WATTS
GRID DISSIPATION - - - - - - -	13 MAX. WATTS

TYPICAL OPERATION (Sinusoidal wave, two tubes unless otherwise specified)

D-C Plate Voltage - - - - - -	1000	1500	2000	volts
D-C Grid Voltage[1] - - - - - -	—70	—130	—190	volts
Peak A-F Grid Input Voltage (per tube)	215	250	300	volts
Zero-Signal D-C Plate Current - -	100	67	50	ma.
Max-Signal D-C Plate Current - -	350	285	250	ma.
Max-Signal Avg. Driving Power (approx.)	7	6	5	watts
Max-Signal Peak Driving Power - -	26	23	19	watts
Effective Load, Plate-to-Plate - -	5300	11,000	18,000	ohms
Max-Signal Plate Power Output - -	200	280	350	watts
Max-Signal Plate Dissipation (per tube)	75	75	75	watts
Total Harmonic Distortion - - -	2.0	4.5	6.0	per cent

[1] Adjust to give stated zero-signal plate current. The effective grid-circuit resistance for each tube must not exceed 250,000 ohms in class-AB$_1$ operation.

APPLICATION

MECHANICAL

Mounting—The 75TL must be mounted vertically, base down or up. The plate and grid leads should be flexible. The tube must be protected from vibration and shock.

Cooling—Heat Dissipating Connectors (Eimac HR-3 and HR-2) should be used at the plate and grid terminals of the 75TL. If the free circulation of air around the tube is restricted, a small fan or centrifugal blower should be used to provide additional cooling for the plate and grid seals.

Cooling requirements will be met if the temperature of the plate and grid seals is not allowed to exceed 225°C. One method of measuring these temperatures is provided by the use of "Tempilaq", a temperature-sensitive lacquer available from the Tempil Corporation, New York 11, N.Y.

ELECTRICAL

Filament Voltage—For maximum tube life the filament voltage, as measured directly at the base pins, should be the rated value of 5.0 volts. Variations must be kept within the range of 4.75 to 5.25 volts.

Bias Voltage—Although there is no maximum limit on the bias voltage which may be used on the 75TL, there is little advantage in using bias voltages in excess of those given under "Typical Operation," except in certain very specialized applications. Where bias is obtained by a grid leak, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation.

Plate Voltage—The plate-supply voltage for the 75TL should not exceed 3000 volts. In most cases there is little advantage in using plate-supply voltages higher than those given under "Typical Operation" for the power output desired.

Grid Dissipation—The power dissipated by the grid of the 75TL must not exceed 13 watts. Grid dissipation may be calculated from the following expression:

$$P_g = e_{cmp} I_c$$

where P_g = Grid dissipation,
e_{cmp} = Peak positive grid voltage, and
I_c = D-c grid current.

e_{cmp} may be measured by means of a suitable peak voltmeter connected between filament and grid.[2] In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading.

Plate Dissipation—The plate of the 75TL operates at a visibly red temperature at its maximum rated dissipation of 75 watts. Plate dissipation in excess of the maximum rating is permissible only for short periods of time, such as during tuning procedures.

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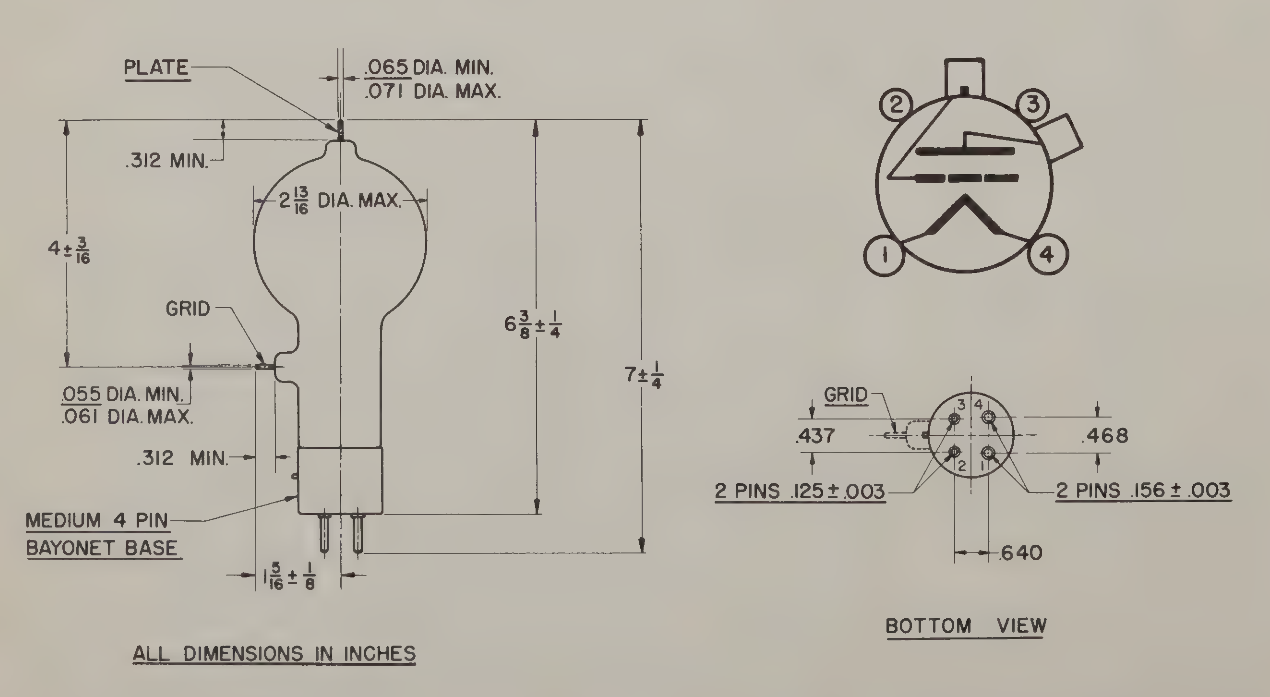
[2] For suitable peak v.t.v.m. circuits see, for instance, "Vacuum Tube Ratings", **Eimac News**, January, 1945. This article is available in reprint form on request.

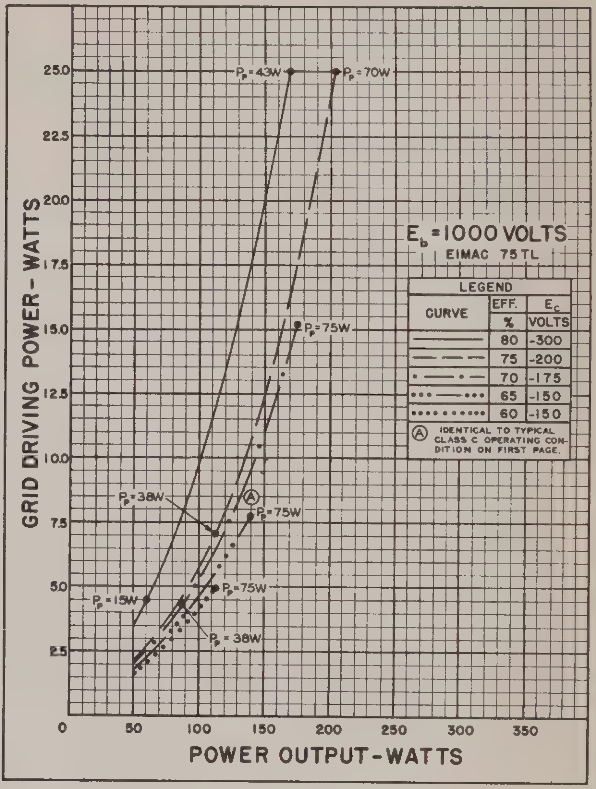


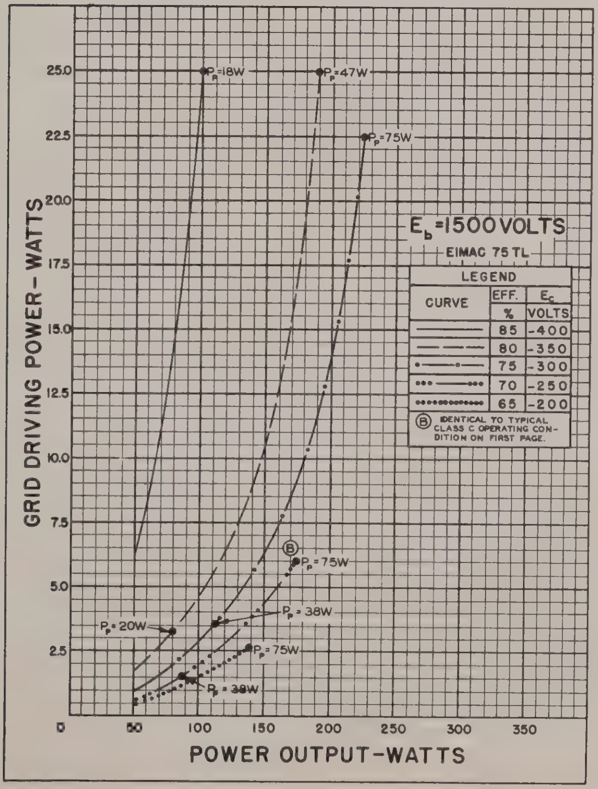
Indicates change from sheet dated 4-1-46.

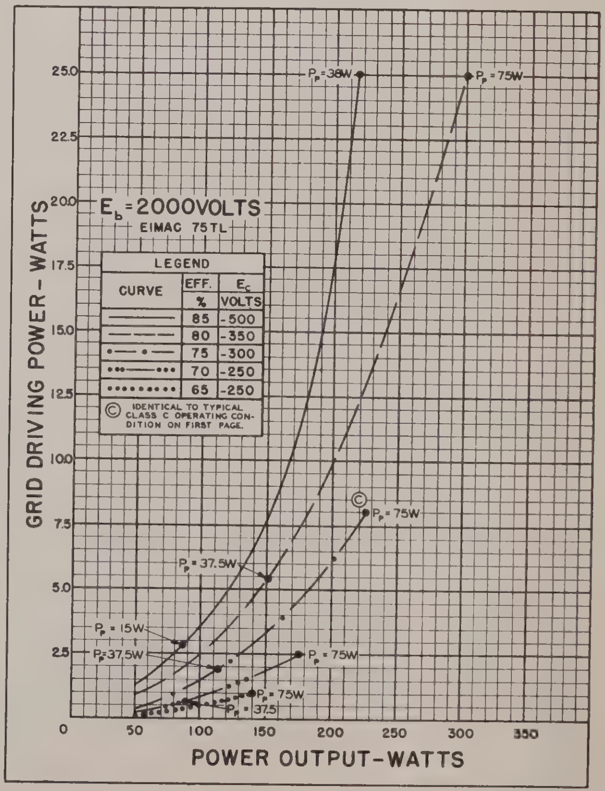
DRIVING POWER vs. POWER OUTPUT

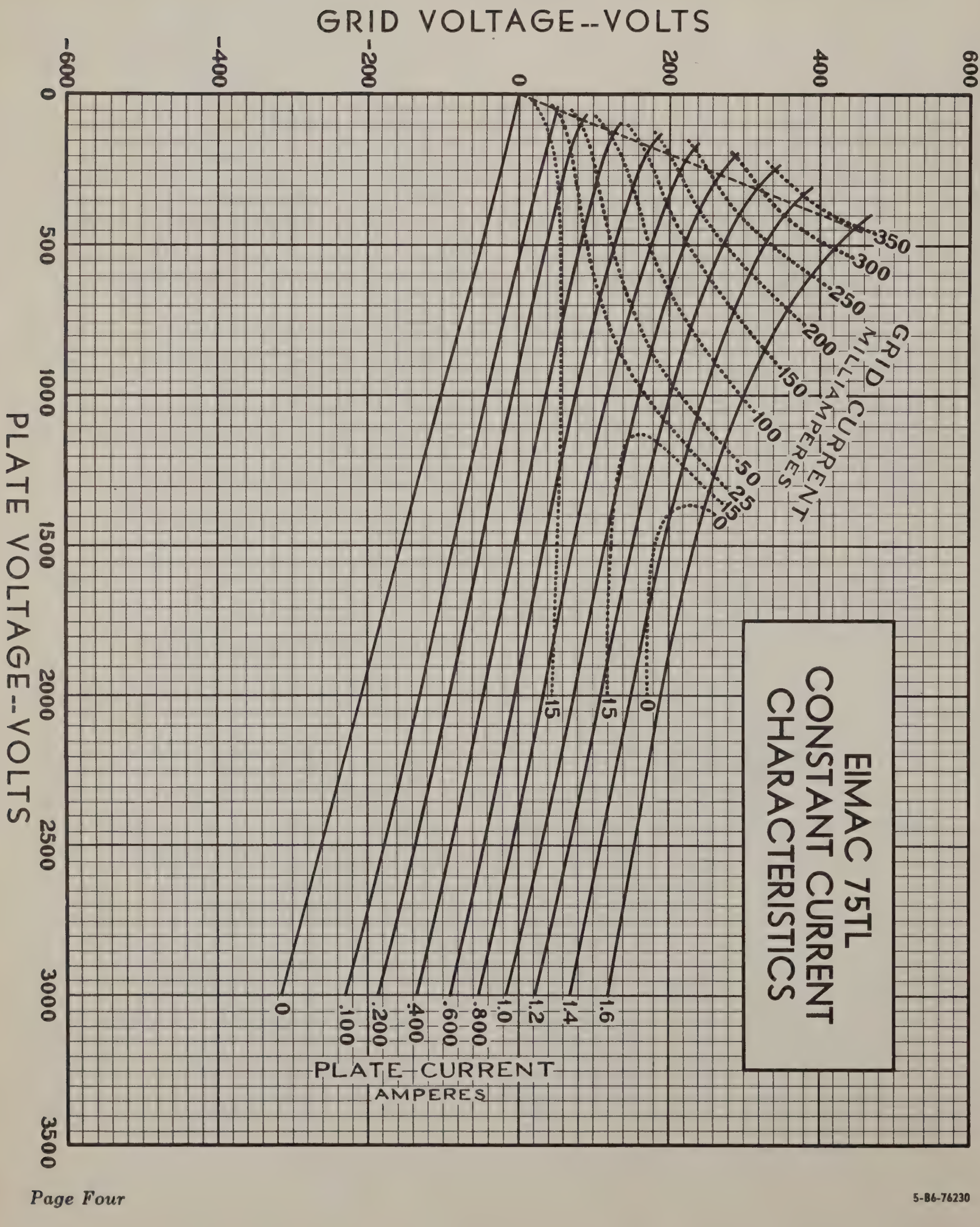
The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 1000, 1500 and 2000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 1000, 1500, and 2000 volts respectively.








EIMAC 75TL
CONSTANT CURRENT
CHARACTERISTICS
GRID VOLTAGE--VOLTS
-600
-400
-200
0
200
400
600
PLATE VOLTAGE--VOLTS
0
500
1000
1500
2000
2500
3000
3500
PLATE CURRENT
AMPERES
0
.100
.200
.400
.600
.800
1.0
1.2
1.4
1.6
GRID CURRENT
MILLIAMPERES
350
300
250
200
150
100
50
25
15
0
15
15
0

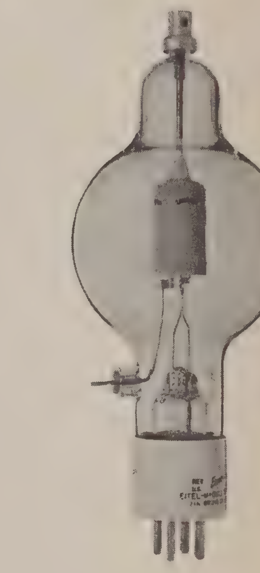
EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

100TH

HIGH-MU TRIODE

•

MODULATOR
OSCILLATOR
AMPLIFIER



The Eimac 100TH is a high-mu power triode having a maximum plate dissipation rating of 100 watts, and is intended for use as an amplifier, oscillator, or modulator. It can be used at its maximum ratings at frequencies as high as 40-Mc.

Cooling of the 100TH is accomplished by radiation from the plate, which operates at a visible red color at maximum dissipation, and by means of air circulation by convection around the envelope.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament:	Thoriated tungsten	
	Voltage	5.0 volts
	Current	6.3 amperes
▶ Amplification Factor (Average)		38
Direct Interelectrode Capacitances (Average)		
	Grid-Plate	2.0 $\mu\mu f$
	Grid-Filament	2.9 $\mu\mu f$
	▶ Plate-Filament	0.3 $\mu\mu f$
▶ Transconductance (i_b=200 ma., E_b=3000v., e_c=–5v.)		4500 μmhos
Frequency for Maximum Ratings		40 Mc.

MECHANICAL

Base	(Medium 4-pin bayonet, ceramic)	RMA type M8-078
Basing		RMA type 2M
▶ Mounting		Vertical, base down or up.
▶ Cooling		Convection and Radiation.
▶ Recommended Heat Dissipating Connectors:		
	Plate	Eimac HR-6
	Grid	Eimac HR-2
Maximum Overall Dimensions:		
	Length	7.75 inches
	Diameter	3.19 inches
Net weight		4 ounces
Shipping weight (Average)		1.5 pounds

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class-AB₂ (Sinusoidal wave, two tubes unless otherwise specified)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	3000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT, PER TUBE	225 MAX. MA.
PLATE DISSIPATION, PER TUBE	100 MAX. WATTS

▶ TYPICAL OPERATION

D-C Plate Voltage	1500	2000	2500	Volts
D-C Grid Voltage (approx.)*	—20	—35	—50	Volts
Zero-Signal D-C Plate Current	80	60	48	Ma.
Max-Signal D-C Plate Current	320	280	250	Ma.
Effective Load, Plate-to-Plate	8800	15,000	22,000	Ohms.
Peak A-F Grid Input Voltage (per tube)	145	150	155	Volts
Max-Signal Peak Driving Power	18	19	15	Watts
Max-Signal Nominal Driving Power (approx.)	9	9.5	7.5	Watts
Max-Signal Plate Power Output	280	360	425	Watts

*Adjust to give stated zero signal plate current.

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony
(Key-down conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	3000 MAX. VOLTS
D-C PLATE CURRENT	225 MAX. MA.
PLATE DISSIPATION	100 MAX. WATTS
▶ GRID DISSIPATION	20 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	1500	2000	3000	Volts
D-C Grid Voltage	—65	—80	—200	Volts
D-C Plate Current	190	165	165	Ma.
D-C Grid Current	48	39	51	Ma.
Peak R-F Grid Input Voltage	230	230	385	Volts
Driving Power (approx.)	10	8	18	Watts
Grid Dissipation	7	5	10	Watts
Plate Power Input	285	335	500	Watts
Plate Dissipation	100	100	100	Watts
Plate Power Output	185	235	400	Watts

▶ PLATE MODULATED RADIO FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	2500 MAX. VOLTS
D-C PLATE CURRENT	180 MAX. MA.
PLATE DISSIPATION	65 MAX. WATTS
GRID DISSIPATION	20 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	1500	2000	2500	Volts
D-C Grid Voltage	—150	—200	—250	Volts
D-C Plate Current	160	150	140	Ma.
D-C Grid Current	46	41	40	Ma.
Peak R-F Grid Input Voltage	325	375	425	Volts
Driving Power (approx.)	15	15.5	17	Watts
Grid Dissipation	8	7.3	7	Watts
Plate Power Input	240	300	350	Watts
Plate Dissipation	65	65	65	Watts
Plate Power Output	175	235	285	Watts

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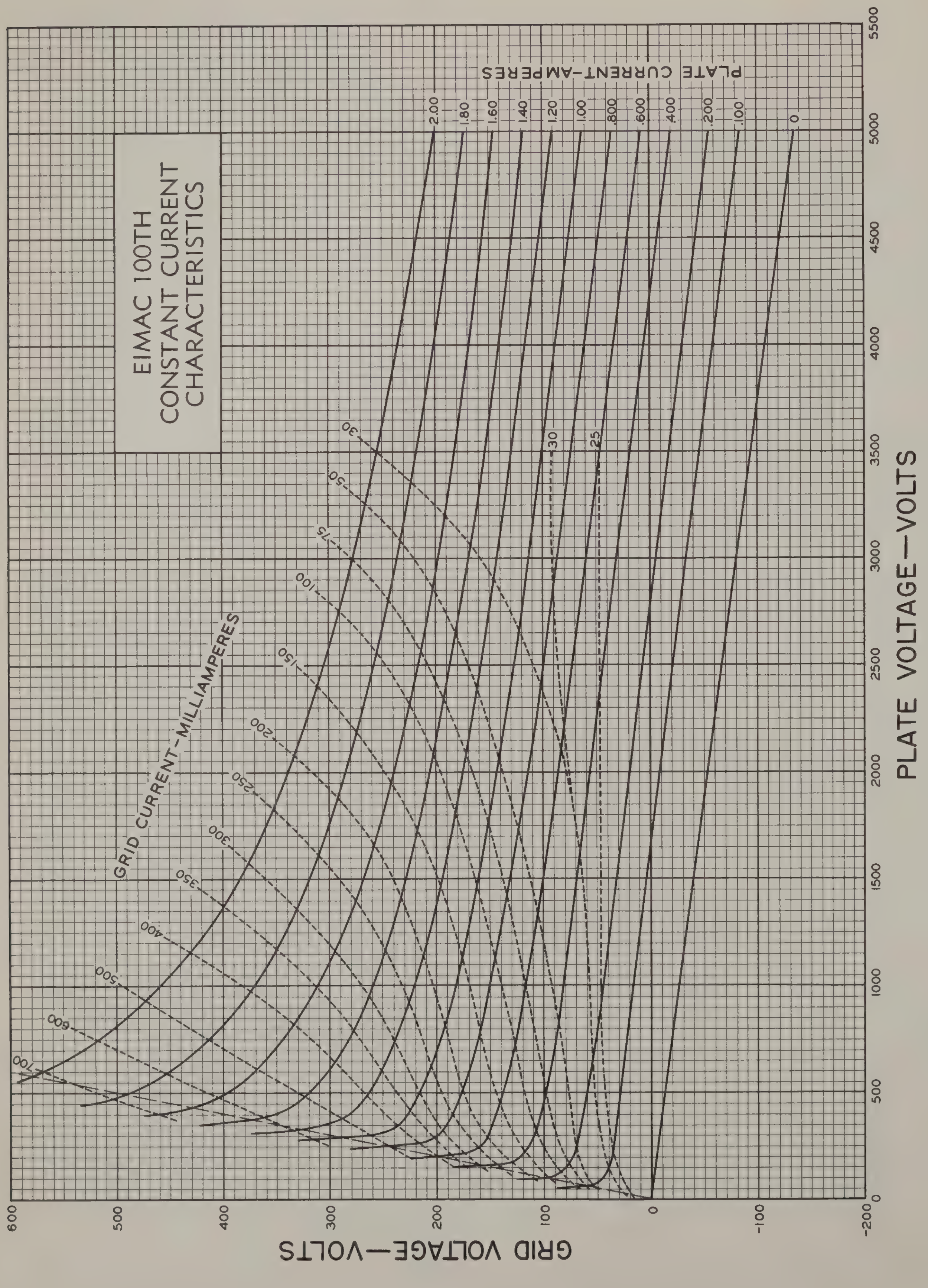
▶ Indicates change from sheet dated 8-1-44.


EIMAC 100TH
CONSTANT CURRENT
CHARACTERISTICS
PLATE CURRENT-AMPERES
2.00
1.80
1.60
1.40
1.20
1.00
.800
.600
.400
.200
.100
0
GRID CURRENT-MILLIAMPERES
700
600
500
400
350
300
250
200
150
100
75
50
30
30
25
PLATE VOLTAGE—VOLTS
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
GRID VOLTAGE—VOLTS
600
500
400
300
200
100
0
-100
-200

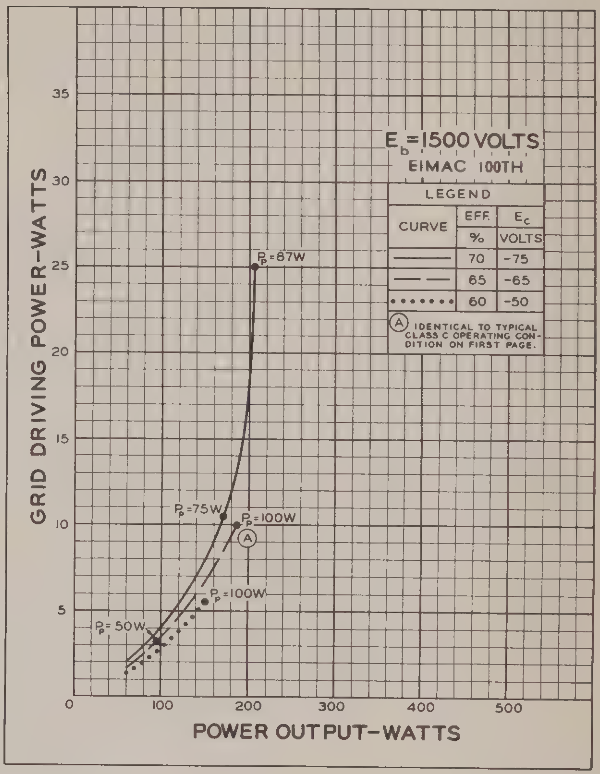
DRIVING POWER vs. POWER OUTPUT

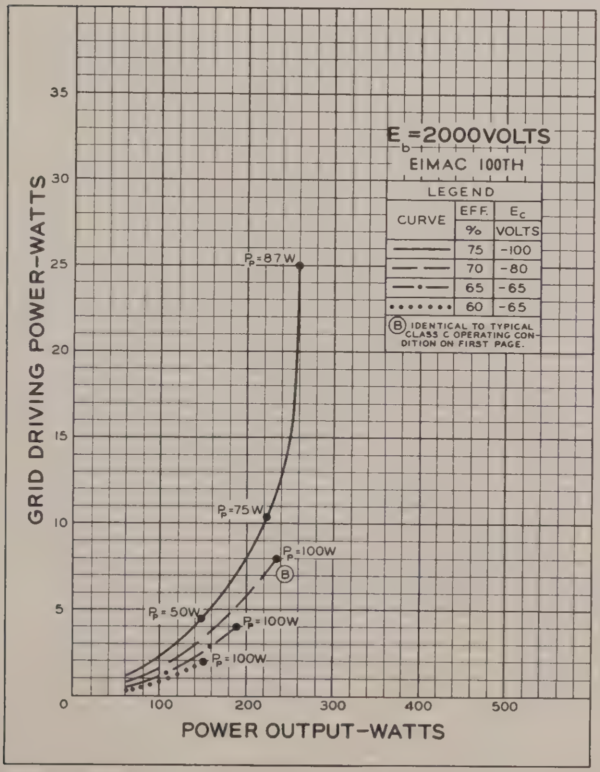
●

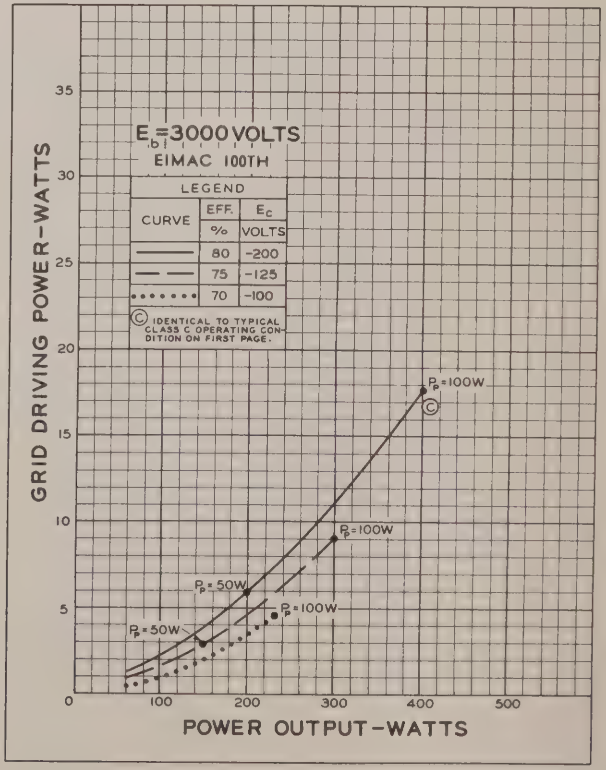
The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 1500, 2000 and 3000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 1500, 2000, and 3000 volts respectively.

●







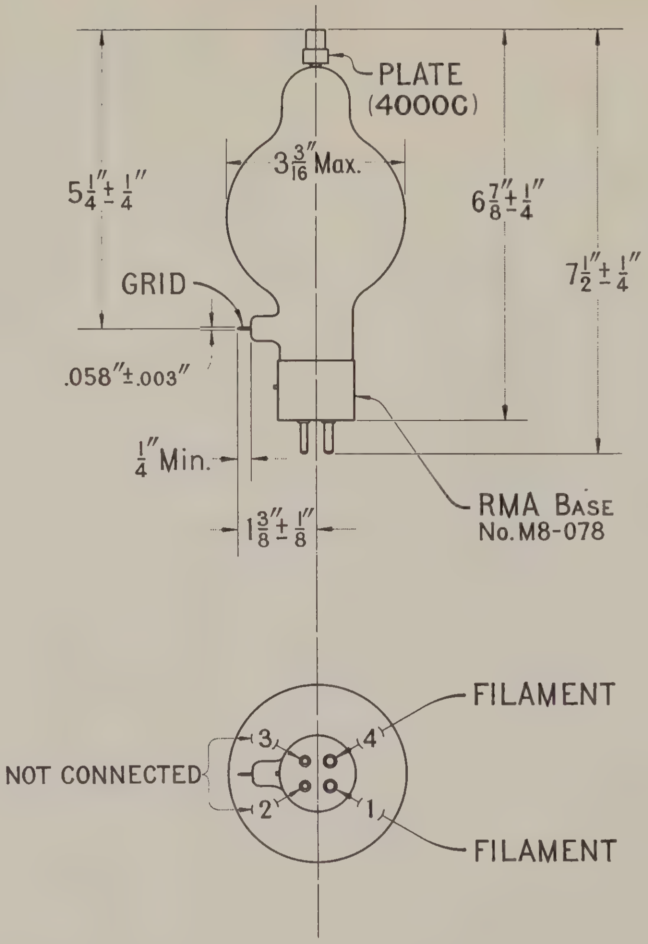


PLATE
(4000C)
$3\frac{3}{16}''$ Max.
$5\frac{1}{4}'' \pm \frac{1}{4}''$
$6\frac{7}{8}'' \pm \frac{1}{4}''$
$7\frac{1}{2}'' \pm \frac{1}{4}''$
GRID
.058″±.003″
$\frac{1}{4}''$ Min.
$1\frac{3}{8}'' \pm \frac{1}{8}''$
RMA BASE
No. M8-078
FILAMENT
NOT CONNECTED
3
4
2
1
FILAMENT

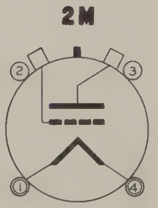
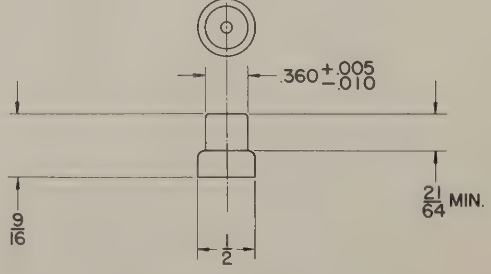


PLATE CAP
NO. 4000C



GRID CAP
(SEE TUBE OUTLINE DRAWING)

EITEL-McCULLOUGH, INC.

SAN BRUNO, CALIFORNIA

100TL

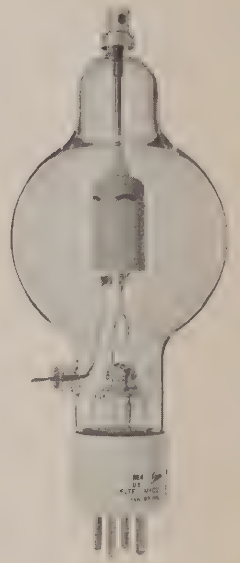
LOW-MU TRIODE

■

MODULATOR
OSCILLATOR
AMPLIFIER

The Eimac 100TL is a low-mu power triode having a maximum plate dissipation rating of 100 watts, and is intended for use as an amplifier, oscillator or modulator. It can be used at its maximum ratings at frequencies as high as 40-Mc.

Cooling of the 100TL is accomplished by radiation from the plate, which operates at a visible red color at maximum dissipation, and by means of air circulation by convection around the envelope.



GENERAL CHARACTERISTICS

ELECTRICAL

Filament:	Thoriated tungsten	
	Voltage	5.0 volts
	Current	6.3 amperes
Amplification Factor (Average)		14
Direct Interelectrode Capacitances (Average)		
	Grid-Plate	2.0 $\mu\mu$f
	Grid-Filament	2.3 $\mu\mu$f
	Plate-Filament	0.4 $\mu\mu$f
▶ Transconductance (i_b=225 ma., E_b=3000v., e_c=–90v.)		3000 μmhos
Frequency for Maximum Ratings		40 Mc.

MECHANICAL

Base	(Medium 4-pin bayonet, ceramic)	RMA type M8-078
Basing		RMA type 2M
▶ Mounting		Vertical, base down or up.
▶ Cooling		Convection and Radiation.
▶ Recommended Heat Dissipating Connectors:		
	Plate	Eimac HR-6
	Grid	Eimac HR-2
Maximum Overall Dimensions:		
	Length	7.75 inches
	Diameter	3.19 inches
Net weight		4 ounces
Shipping weight (Average)		1.5 pounds

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class-AB$_2$ (Sinusoidal wave, two tubes unless otherwise specified)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	3000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT, PER TUBE	225 MAX. MA.
PLATE DISSIPATION, PER TUBE	100 MAX. WATTS

▶ TYPICAL OPERATION

D-C Plate Voltage	1500	2000	2500	Volts
D-C Grid Voltage (approx.)*	—65	—110	—145	Volts
Zero-Signal D-C Plate Current	80	60	48	Ma.
Max-Signal D-C Plate Current	320	280	250	Ma.
Effective Load, Plate-to-Plate	8800	15,000	22,000	Ohms
Peak A-F Grid Input Voltage (per tube)	235	270	290	Volts
Max-Signal Peak Driving Power	21	22	20	Watts
Max-Signal Nominal Driving Power (approx.)	10.5	11	10	Watts
Max-Signal Plate Power Output	280	360	425	Watts

*Adjust to give stated zero signal plate current.

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony
(Key-down conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	3000 MAX. VOLTS
D-C PLATE CURRENT	225 MAX. MA.
PLATE DISSIPATION	100 MAX. WATTS
▶ GRID DISSIPATION	15 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	1500	2000	3000	Volts
D-C Grid Voltage	—175	—225	—400	Volts
D-C Plate Current	190	165	165	Ma.
D-C Grid Current	37	28	30	Ma.
Peak R-F Grid Input Voltage	425	450	650	Volts
Driving Power (approx.)	14	11	20	Watts
Grid Dissipation	7.5	5	8	Watts
Plate Power Input	285	335	500	Watts
Plate Dissipation	100	100	100	Watts
Plate Power Output	185	235	400	Watts

▶ PLATE MODULATED RADIO FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	2500 MAX. VOLTS
D-C PLATE CURRENT	180 MAX. MA.
PLATE DISSIPATION	65 MAX. WATTS
GRID DISSIPATION	15 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	1500	2000	2500	Volts
D-C Grid Voltage	—300	—400	—500	Volts
D-C Plate Current	160	150	140	Ma.
D-C Grid Current	32	31	31	Ma.
Peak R-F Grid Input Voltage	530	655	750	Volts
Driving Power (approx.)	17	20	23	Watts
Grid Dissipation	8	7.5	7.5	Watts
Plate Power Input	240	300	350	Watts
Plate Dissipation	65	65	65	Watts
Plate Power Output	175	235	285	Watts

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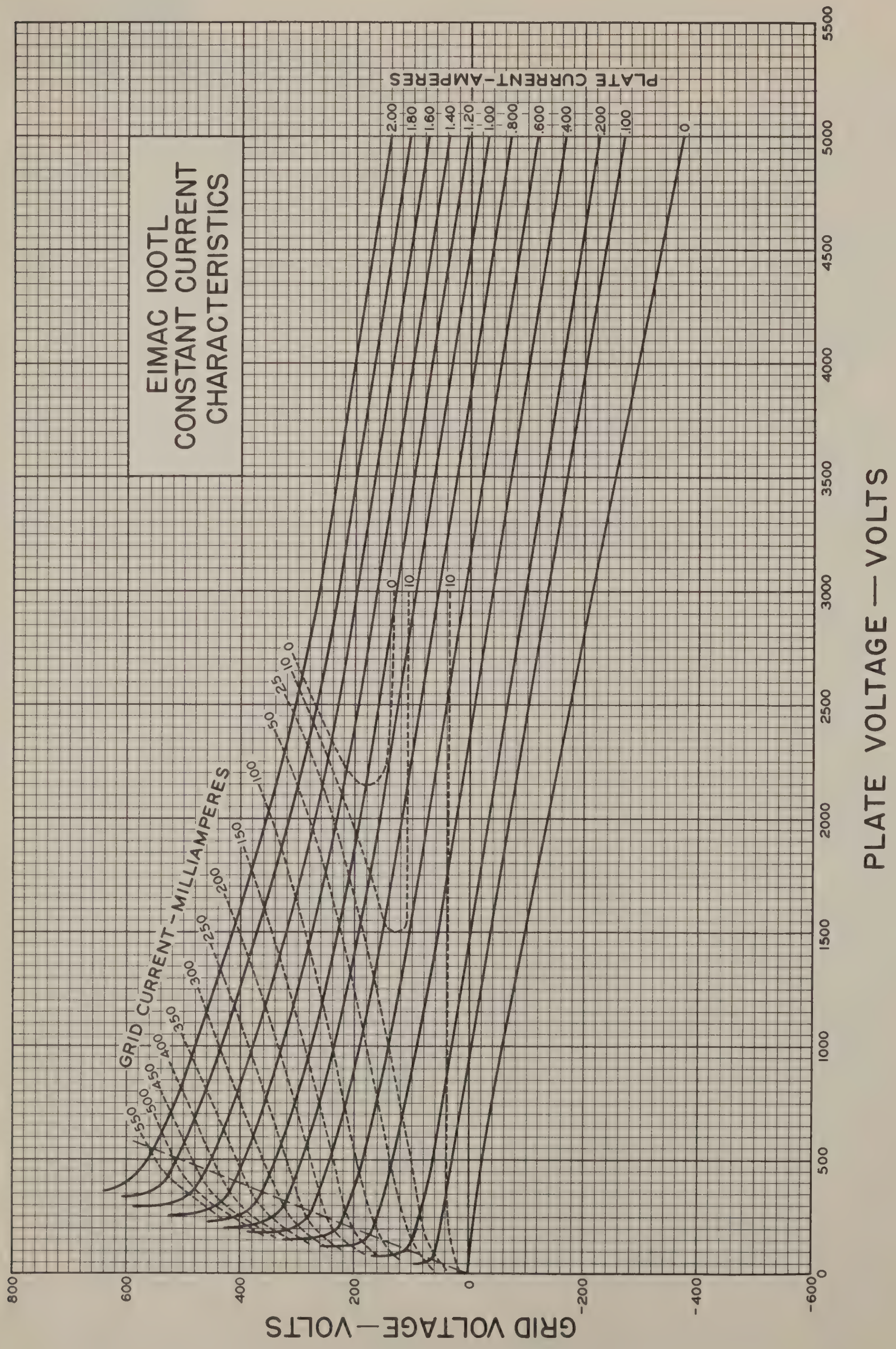
▶ Indicates change from sheet dated 7-1-44.


EIMAC 100TL
CONSTANT CURRENT
CHARACTERISTICS
PLATE CURRENT-AMPERES
2.00
1.80
1.60
1.40
1.20
1.00
.800
.600
.400
.200
.100
0
GRID CURRENT-MILLIAMPERES
550
500
450
400
350
300
250
200
150
100
50
25
10
0
0
10
10
PLATE VOLTAGE — VOLTS
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
GRID VOLTAGE — VOLTS
800
600
400
200
0
-200
-400
-600

DRIVING POWER vs. POWER OUTPUT

•

The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 1500, 2000 and 3000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P p.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 1500, 2000, and 3000 volts respectively.

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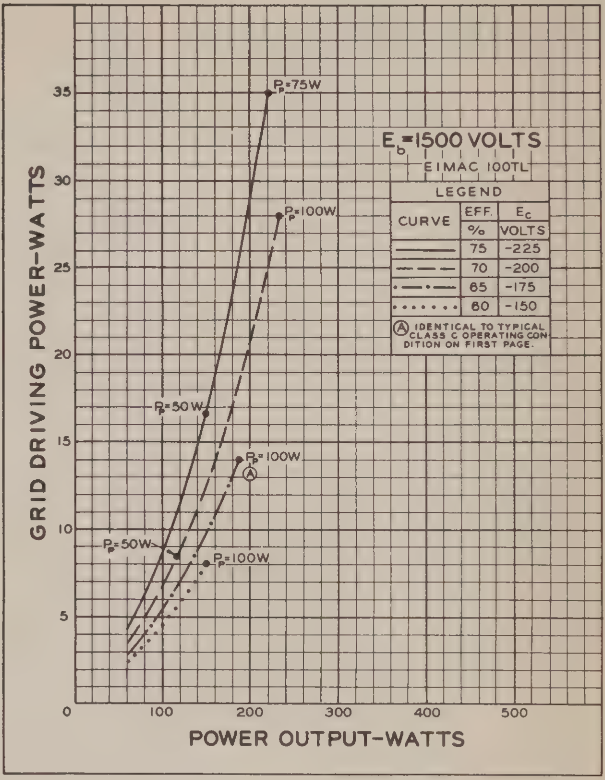
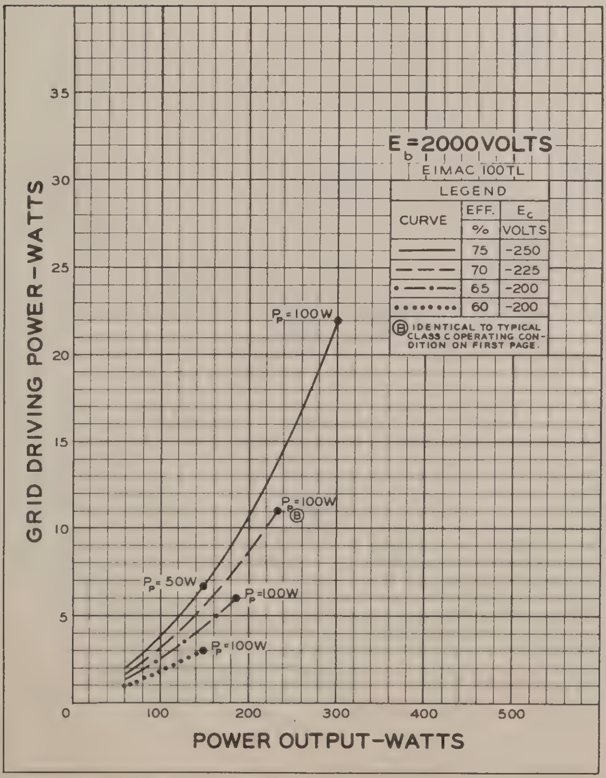
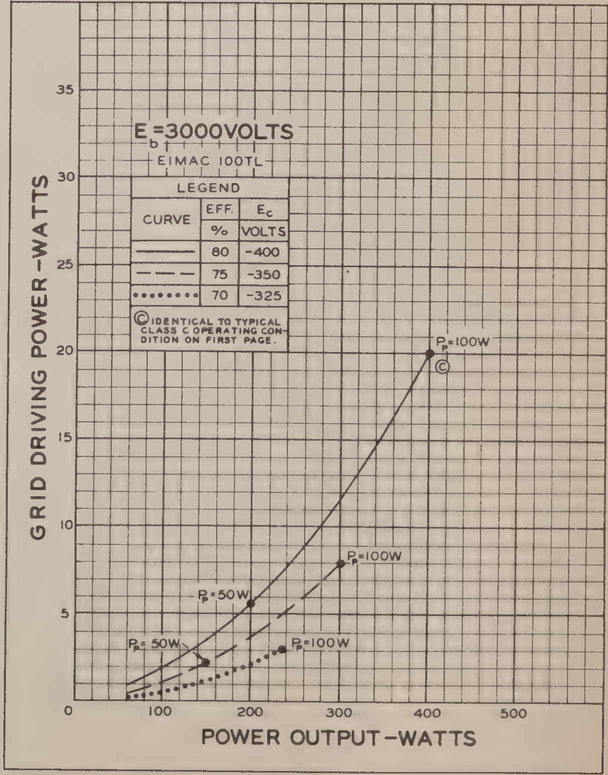
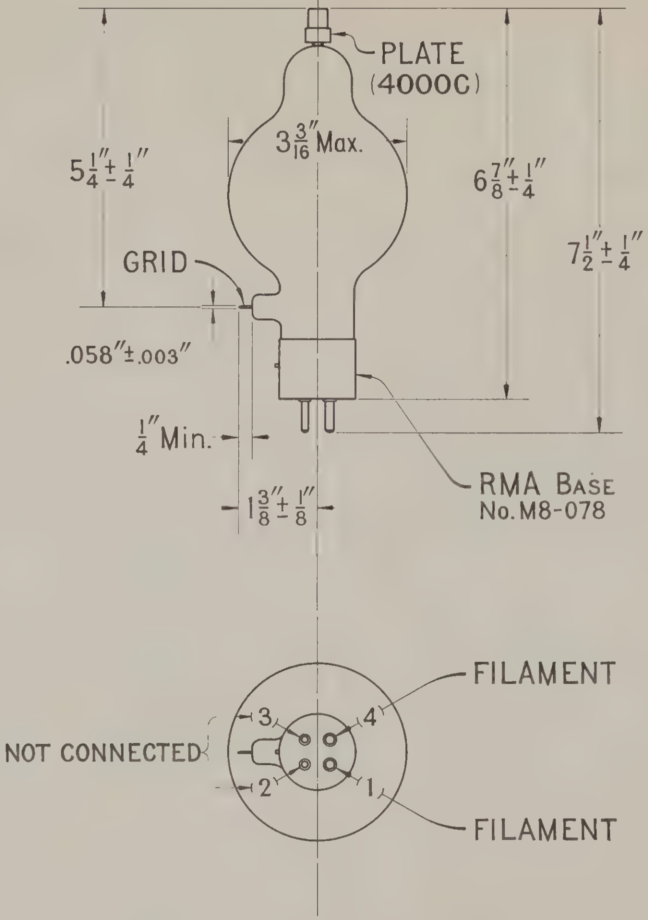








2M

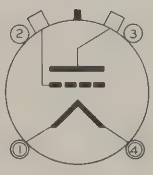
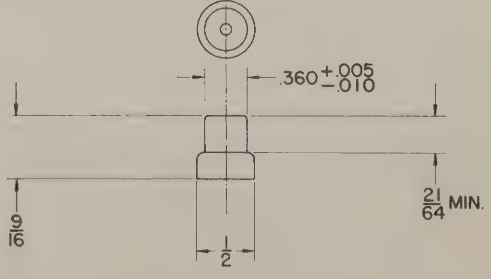


PLATE CAP
NO. 4000C

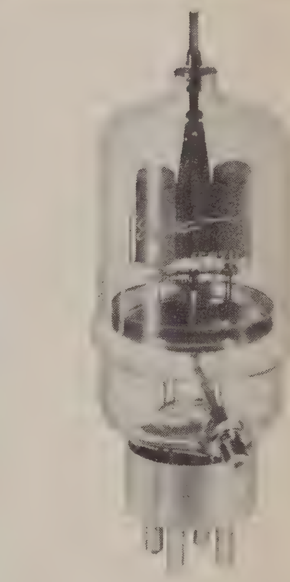


GRID CAP
(SEE TUBE OUTLINE DRAWING)

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

152 TH

MEDIUM-MU TRIODE
•
MODULATOR
OSCILLATOR
AMPLIFIER



► The Eimac 152TH is a medium-mu power triode intended for use as an amplifier, oscillator or modulator. It has a maximum plate-dissipation rating of 150 watts and a maximum plate-voltage rating of 3000 volts at frequencies up to 40 Mc.

The 152TH in class-C r-f service will deliver up to 600 watts plate power output with 27 watts driving power. Two 152TH's in class-B modulator service will deliver up to 600 watts maximum-signal plate power output with 8 watts nominal driving power.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten	
Voltage	5.0 or 10.0 volts
Current	12.5 or 6.25 amperes
Amplification Factor (Average)	20
Direct Interelectrode Capacitances (Average)	
Grid-Plate	4.8 μμfd
Grid-Filament	5.7 μμfd
► Plate-Filament	0.4 μμfd
Transconductance (I_b=500 ma., E_b=3000 v.)	8300 μmhos
Highest Frequency for Maximum Ratings	40 Mc

►MECHANICAL

Base	Special 4-pin
Basing	See outline drawing
Socket	Johnson type No. 124-213 or equivalent
Mounting Position	Vertical, base down or up
Cooling	Convection and radiation
Maximum Temperature of Plate and Grid Seals	225° C
Recommended Heat-Dissipating Connectors:	
Plate	Eimac HR-5
Grid	Eimac HR-6
Maximum Over-all Dimensions:	
Length	7.63 inches
Diameter	2.57 inches
Net Weight	8 ounces
Shipping Weight	1.25 pounds

RADIO-FREQUENCY POWER AMPLIFIER OR OSCILLATOR

Class-C Telegraphy (Key-down conditions, one tube)

MAXIMUM RATINGS (Frequencies up to 40 Mc.)

D-C PLATE VOLTAGE	3000 MAX. VOLTS
D-C PLATE CURRENT	450 MAX. MA
PLATE DISSIPATION	150 MAX. WATTS
GRID DISSIPATION	30 MAX. WATTS

TYPICAL OPERATION (Frequencies up to 40 Mc.)

D-C Plate Voltage	1500	2000	3000	volts
D-C Grid Voltage	–125	–200	–300	volts
D-C Plate Current	335	300	250	ma
D-C Grid Current*	58	75	70	ma
Peak R-F Grid Voltage	265	335	410	volts
Driving Power*	13	20	27	watts
Plate Power Input	500	600	750	watts
Plate Dissipation	150	150	150	watts
Plate Power Output	350	450	600	watts

►PLATE-MODULATED RADIO-FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS (Frequencies up to 40 Mc.)

D-C PLATE VOLTAGE	2500 MAX. VOLTS
D-C PLATE CURRENT	350 MAX. MA
PLATE DISSIPATION	100 MAX. WATTS
GRID DISSIPATION	30 MAX. WATTS

TYPICAL OPERATION (Frequencies up to 40 Mc.)

D-C Plate Voltage	1000	1500	2000	2500	volts
D-C Grid Voltage	–150	–200	–300	–350	volts
D-C Plate Current	270	235	220	200	ma
D-C Grid Current*	40	28	30	30	ma
Peak R-F Grid Voltage	300	330	440	485	volts
Driving Power*	12	10	12	15	watts
Grid Dissipation*	6	4	4	4	watts
Plate Power Input	270	350	440	500	watts
Plate Dissipation	100	100	100	100	watts
Plate Power Output	170	250	340	400	watts

►AUDIO-FREQUENCY POWER AMPLIFIER OR MODULATOR

Class-B

MAXIMUM RATINGS (Per tube)

D-C PLATE VOLTAGE	3000 MAX. VOLTS
D-C PLATE CURRENT	450 MAX. MA
PLATE DISSIPATION	150 MAX. WATTS

TYPICAL OPERATION (Sinusoidal wave, two tubes unless otherwise specified)

D-C Plate Voltage	1500	2000	2500	volts
D-C Grid Voltage[1]	–65	–95	–125	volts
Zero-Signal D-C Plate Current	65	50	40	ma
Max-Signal D-C Plate Current	515	405	340	ma
Effective Load, Plate-to-Plate	6000	11,000	17,000	ohms
Peak A-F Grid Voltage (per tube)	165	175	195	volts
Max-Signal Peak Driving Power*	25	17	16	watts
Max-Signal Nominal Driving Power*	13	9	8	watts
Max-Signal Plate Power Input	775	810	850	watts
Max-Signal Plate Power Output	500	550	600	watts

*Approximate values.

[1] Adjust to give stated Zero-Signal D-C Plate Current.

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER "TYPICAL OPERATION," POSSIBLY EXCEEDING THE MAXIMUM RATINGS GIVEN FOR CW SERVICE, WRITE EITEL-McCULLOUGH, INC., FOR INFORMATION AND RECOMMENDATIONS.

(Effective 11-25-52) Copyright 1952 by Eitel-McCullough, Inc.

► Indicates change from sheet dated 6-1-44.

▶ APPLICATION

MECHANICAL

Mounting—The 152TH must be mounted vertically, base down or up. The plate and grid leads should be flexible, and the tube must be protected from vibration and shock.

Cooling—Heat Dissipating Connectors (Eimac HR-5 and HR-6 or equivalent) must be used at the plate and grid terminals of the 152TH. Forced-air cooling is not required in properly designed equipment operating at frequencies below 40 Mc. If the free circulation of air around the tube is restricted, a small fan or centrifugal blower should be used to provide additional cooling.

The temperature of the plate and grid seals must not be allowed to exceed 225° C. One method of measuring these temperatures is by the use of "Tempilaq," a temperature-sensitive lacquer manufactured by the Tempil Corporation, 132 W. 22nd St., New York 11, N. Y.

ELECTRICAL

Filament Voltage—The filaments of the 152TH may be operated either at 10.0 volts when connected in series or at 5.0 volts when connected in parallel (see basing diagram). For maximum tube life the filament voltage should be maintained at the rated value. Variations must not be allowed to exceed ± 5%.

Bias Voltage—When grid-leak bias is used, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation, and the grid-leak resistor should be made adjustable to facilitate maintaining the bias voltage and plate current at the desired value from tube to tube.

Grid Dissipation—The power dissipated by the grid of the 152TH must not exceed 30 watts. Grid dissipation may be calculated from the following expression.

$$P_g = e_{cmp} I_c$$

where P_g = grid dissipation,
e_{cmp} = peak positive grid voltage, and
I_c = d-c grid current.

e_{cmp} may be measured by means of a suitable peak-reading voltmeter connected between filament and grid.[1] In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading.

Plate Dissipation—The plates of the 152TH operate at a visibly red color at the maximum rated dissipation of 150 watts. Plate dissipation in excess of the maximum rating is permissible only for short periods of time, such as during tuning procedures.

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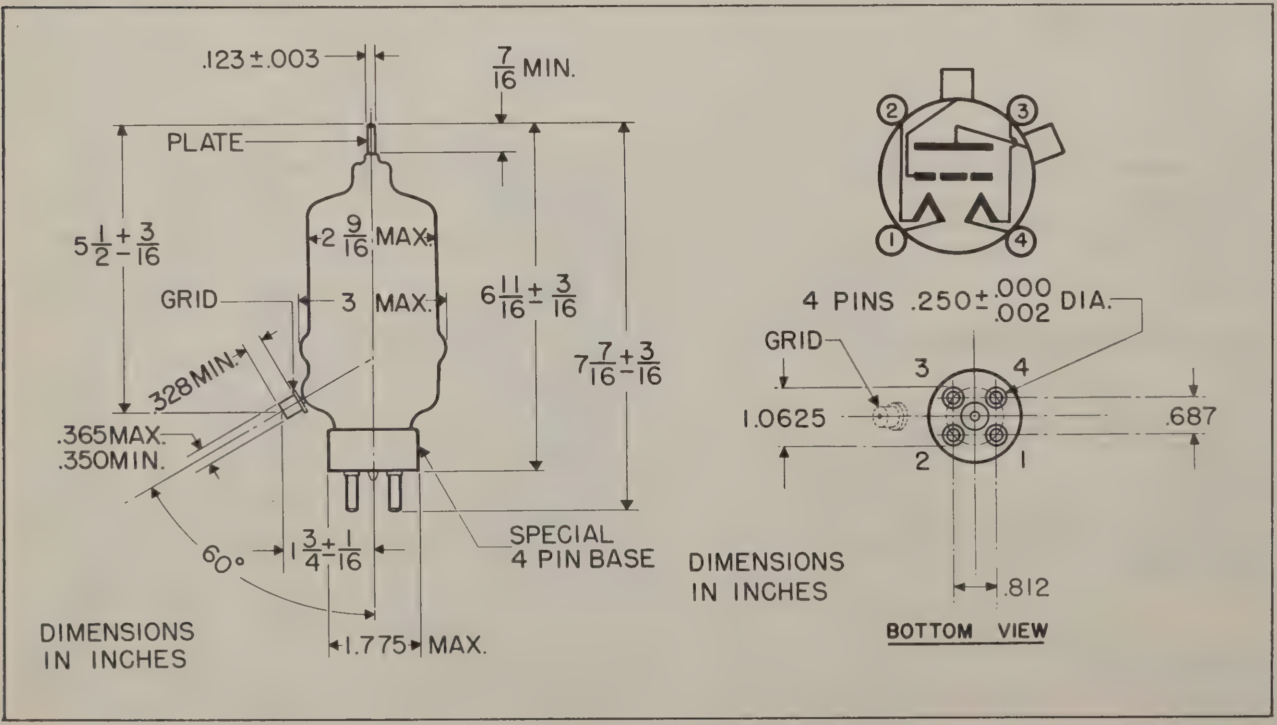
[1] For suitable peak v.t.v.m. circuits see, for instance, "Vacuum Tube Ratings," **Eimac News**, January, 1945. This article is available in reprint form on request.



▶ Indicates change from sheet dated 6-1-44.

DRIVING POWER vs. POWER OUTPUT

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The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 1500, 2000 and 3000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 1500, 2000, and 3000 volts respectively.

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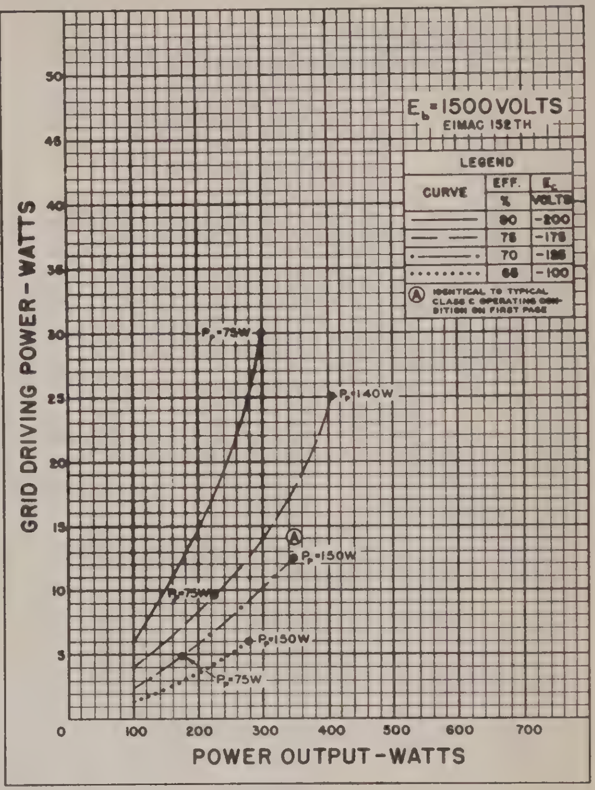

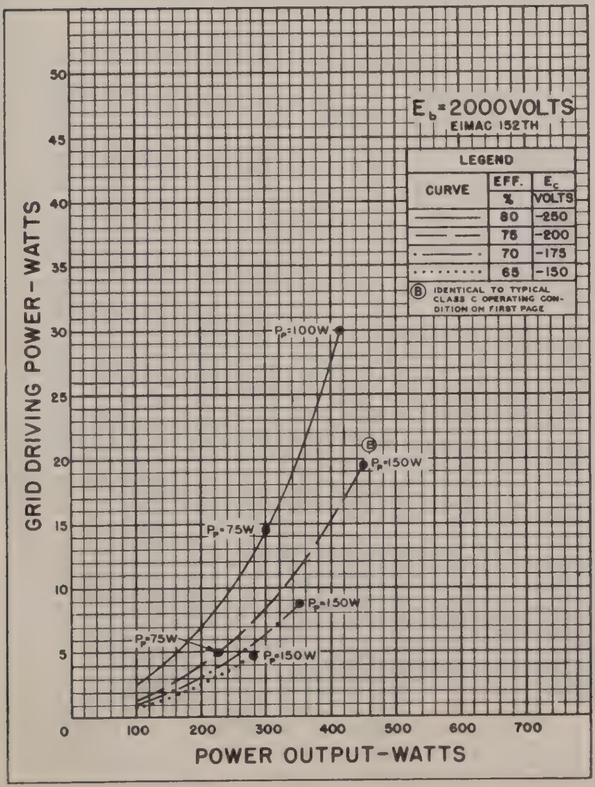

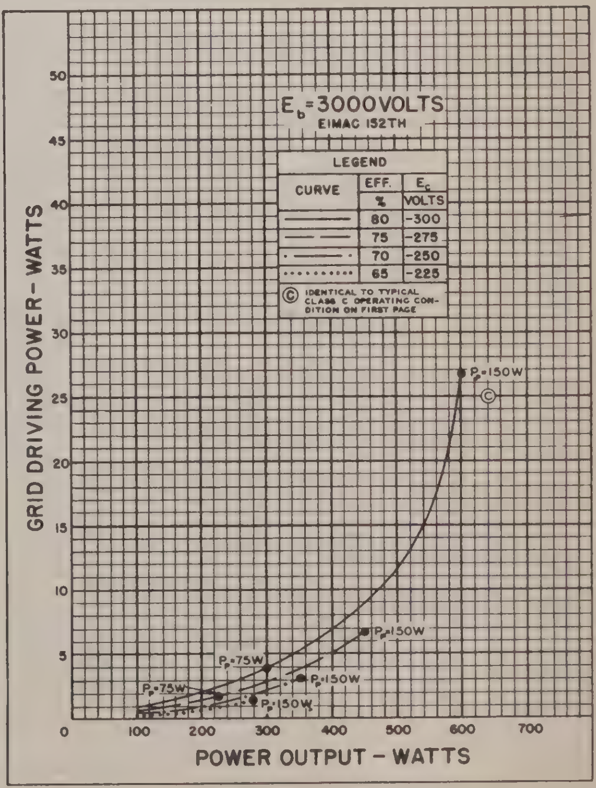

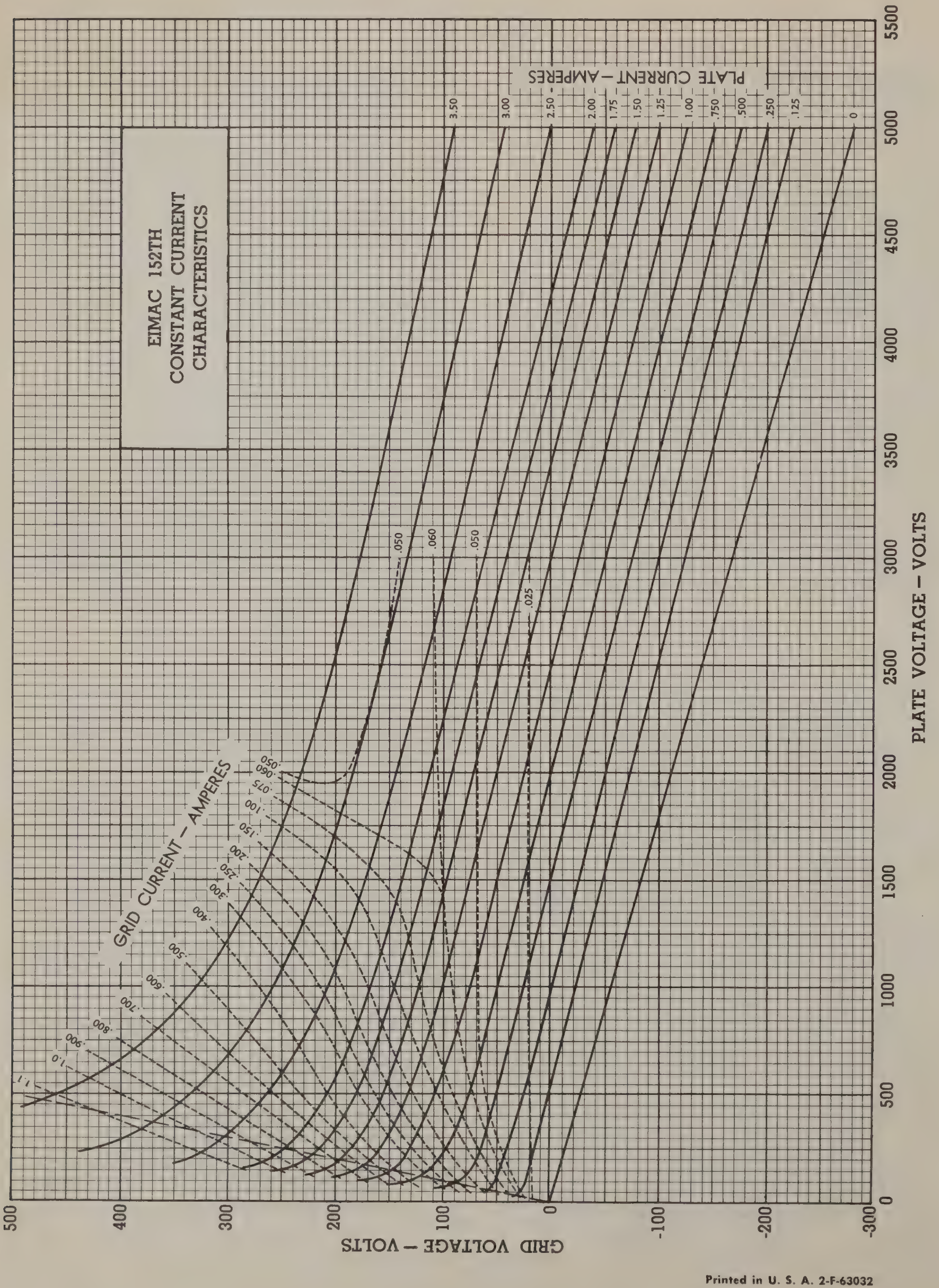
EIMAC 152TH
CONSTANT CURRENT
CHARACTERISTICS
PLATE CURRENT — AMPERES
3.50
3.00
2.50
2.00
1.75
1.50
1.25
1.00
.750
.500
.250
.125
0
GRID CURRENT — AMPERES
.050
.060
.075
.100
.150
.200
.250
.300
.400
.500
.600
.700
.800
.900
1.0
1.1
.050
.060
.050
.025
PLATE VOLTAGE — VOLTS
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
GRID VOLTAGE — VOLTS
500
400
300
200
100
0
-100
-200
-300

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

152TL

LOW-MU TRIODE
•
MODULATOR
OSCILLATOR
AMPLIFIER

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated tungsten

Voltage	5.0 of 10.0	volts
Current	12.5 or 6.25	amperes

Amplification Factor (Average)	12

Direct Interelectrode Capacitances (Average)

Grid-Plate	4.4 μμf
Grid-Filament	4.5 μμf
Plate-Filament	0.7 μμf
Transconductance ($i_b = 500$ ma., $E_b = 3000$ v., $E_c = -85$ v.)	7150 umhos

MECHANICAL

Base	Special 4 pin, No. 5000B
Basing	RMA type 4BC
Maximum Overall Dimensions:	
Length	7.625 inches
Diameter	2.563 inches
Net weight	7 ounces
Shipping weight (Average)	2.0 pounds

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class B

	ZERO GRID CURRENT OPERATION—2 TUBES			TYPICAL OPERATION 2 TUBES			MAX. RATING	
D-C Plate Voltage	1500	2000	3000	1500	2000	3000	3000	volts
Max.-Sig. D-C Plate Current, per tube*	•	•	•	•	•	•	450	ma.
Plate Dissipation, per tube*	•	•	•	•	•	•	150	watts
D-C Grid Voltage (approx.)	–105	–160	–260	–105	–160	–260		volts
Peak A-F Grid Input Voltage	210	320	520	500	620	675		volts
Zero-Signal D-C Plate Current	135	100	65	135	100	65		ma.
Max.-Signal D-C Plate Current	286	260	220	570	500	335		ma.
Max.-Signal Driving Power (approx.)	0	0	0	15	13	3		watts
Effective Load, Plate-to-Plate	5100	10500	24000	5500	9000	20400		ohms
Max.-Signal Plate Power Output	130	220	370	560	700	700		watts

*Averaged over any sinusoidal audio frequency cycle.

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C *Telegraphy

(Key down conditions without modulation)

	TYPICAL OPERATION—1 TUBE			MAX. RATING	
D-C Plate Voltage	1500	2000	3000	3000	volts
D-C Plate Current	333	300	250	450	ma.
D-C Grid Current	45	42	40	75	ma.
D-C Grid Voltage	–250	–300	–400		volts
Plate Power Output	350	450	600		watts
Plate Input	500	600	750		watts
Plate Dissipation	150	150	150	150	watts
Peak R. F. Grid Input Voltage, (approx.)	400	455	550		volts
Driving Power, (approx.)	16	18	20		watts

*The above figures show actual measured tube performance, and do not allow for variations in circuit losses.

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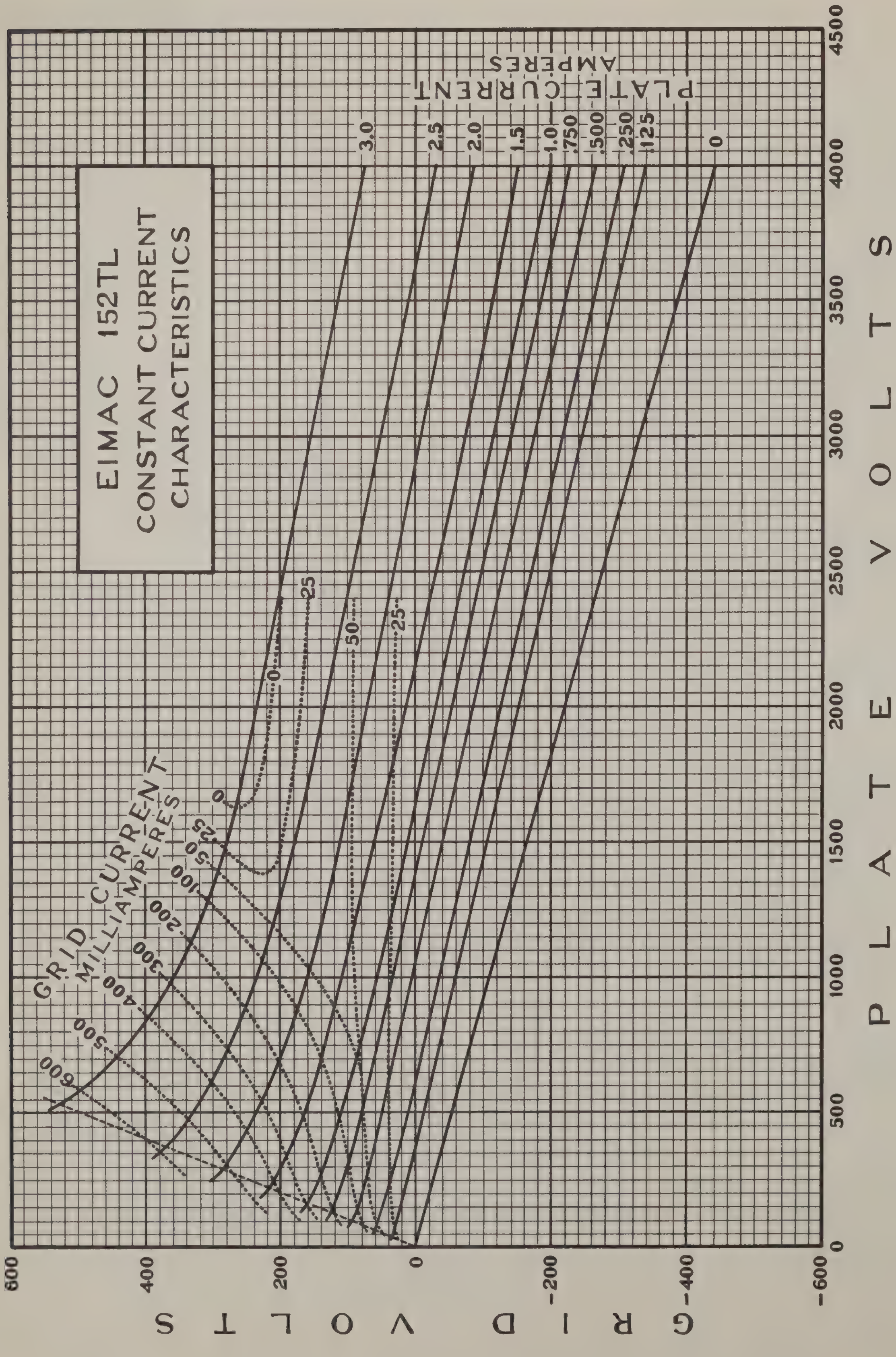
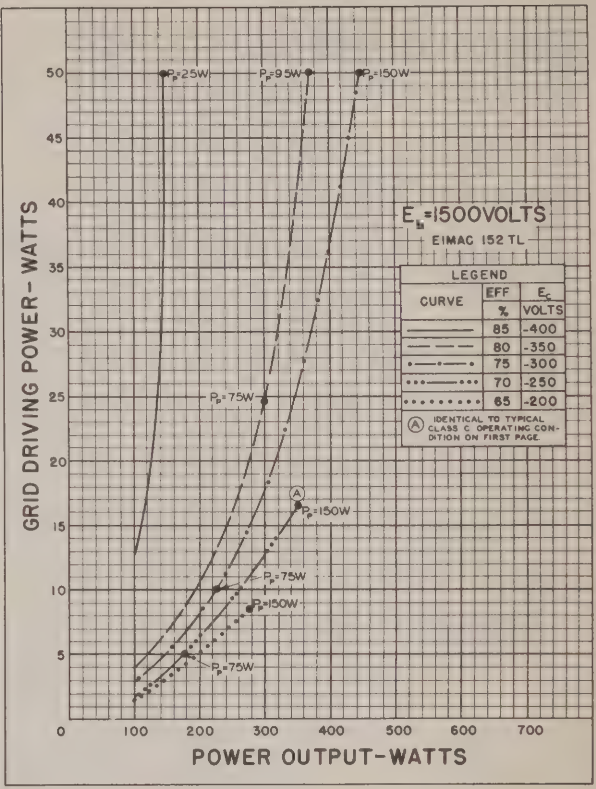
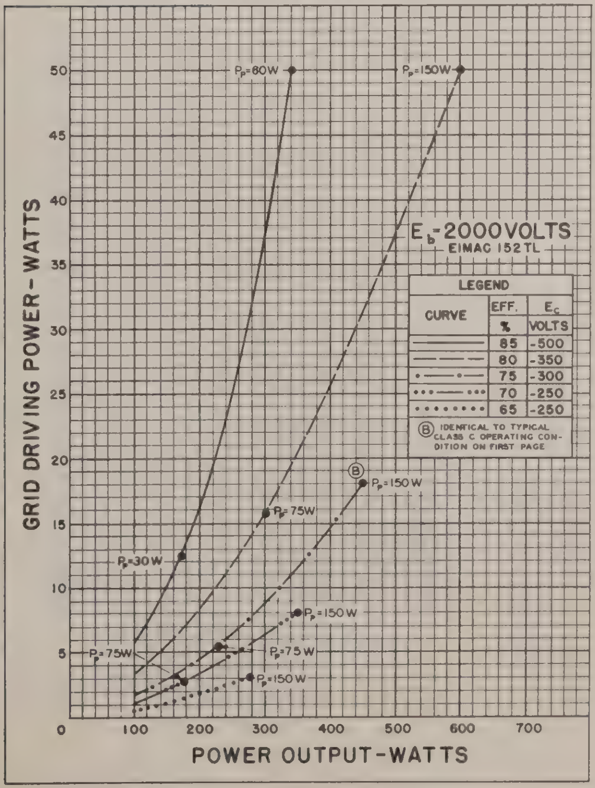

EIMAC 152TL
CONSTANT CURRENT
CHARACTERISTICS
PLATE CURRENT
AMPERES
3.0
2.5
2.0
1.5
1.0
.750
.500
.250
.125
0
GRID CURRENT
MILLIAMPERES
600
500
400
300
200
100
50
25
0
0
25
50
25
PLATE VOLTS
0
500
1000
1500
2000
2500
3000
3500
4000
4500
GRID VOLTS
600
400
200
0
-200
-400
-600

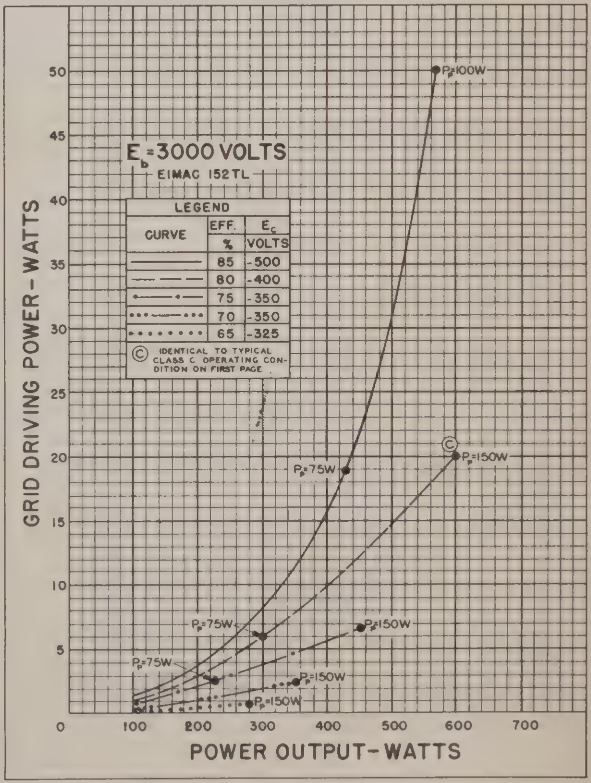
DRIVING POWER vs. POWER OUTPUT

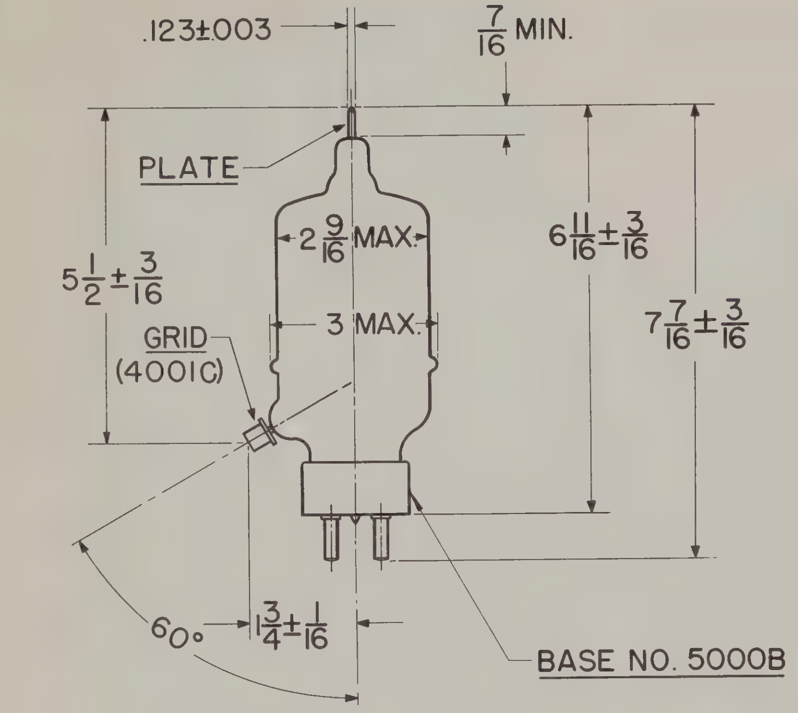
The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 1500, 2000 and 3000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

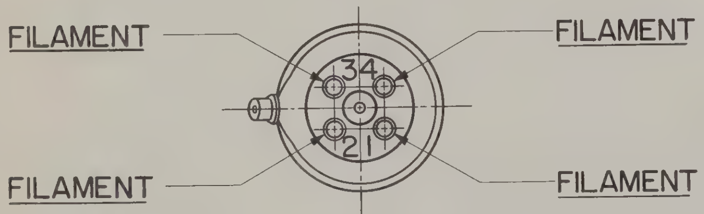
Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 1500, 2000, and 3000 volts respectively.











4BC

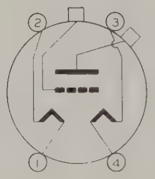
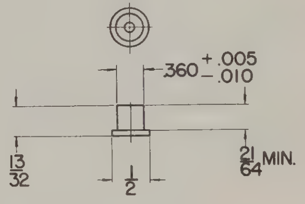


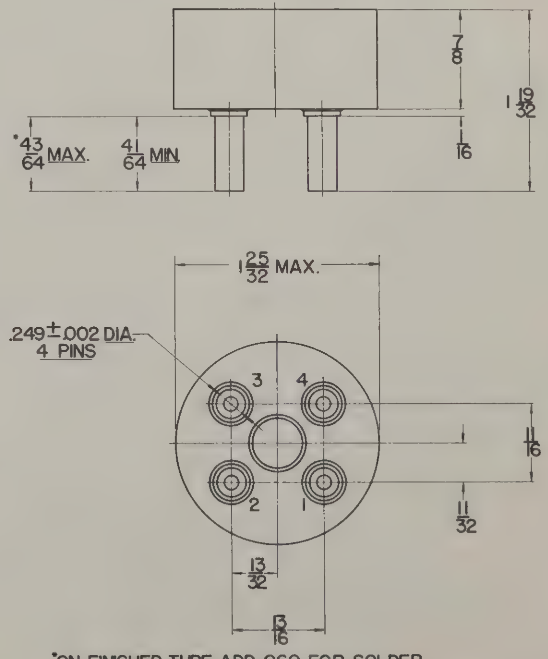
PLATE CAP

(SEE TUBE OUTLINE DRAWING)

GRID CAP
NO. 4001C



BASE NO. 5000B



*ON FINISHED TUBE ADD .060 FOR SOLDER

EITEL-McCULLOUGH, INC.

SAN BRUNO, CALIFORNIA

250TH

HIGH-MU TRIODE

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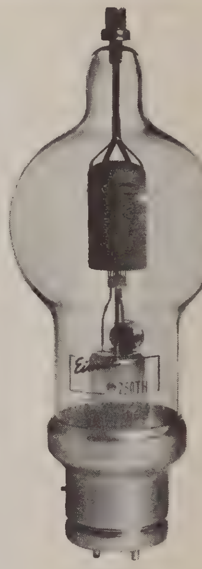
MODULATOR
OSCILLATOR
AMPLIFIER



The Eimac 250TH is a high-mu power triode intended for use as an amplifier, oscillator or modulator. It has a maximum plate-dissipation rating of 250 watts and a maximum plate-voltage rating of 4000 volts at frequencies up to 40 Mc.

The 250TH in class-C r-f service will deliver up to 1000 watts plate power output with 39 watts driving power. Two 250TH's in class-AB_2 modulator service will deliver up to 1180 watts maximum-signal plate power output with 42 watts nominal driving power.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten	
Voltage	5.0 volts
Current	10.5 amperes
Amplification Factor (Average)	37
Direct Interelectrode Capacitances (Average)	
Grid-Plate	2.9 μμf
Grid-Filament	4.6 μμf
Plate-Filament	0.5 μμf
Transconductance (I_b=300 ma., E_b=3000 v.)	5600 μmhos
Highest Frequency for Maximum Ratings	40 Mc

MECHANICAL

Base	Special 4-pin
Basing	See outline drawing
Socket	National No. XM-50 E. F. Johnson No. 123-211 — or equivalent
Mounting Position	Vertical, base down or up
Cooling	Convection and radiation
Maximum Temperature of Plate and Grid Seals	225°C
Recommended Heat-Dissipating Connectors:	
Plate	Eimac HR-6
Grid	Eimac HR-3
Maximum Over-all Dimensions:	
Length	10.13 inches
Diameter	3.81 inches
Net Weight	10 ounces
Shipping Weight	3 pounds

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony
(Key-down conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	4000 MAX. VOLTS
D-C PLATE CURRENT	350 MAX. MA
PLATE DISSIPATION	250 MAX. WATTS
GRID DISSIPATION	40 MAX. WATTS

TYPICAL OPERATION, per tube (Frequencies up to 40 Mc.)

D-C Plate Voltage	2000	3000	4000	volts
D-C Grid Voltage	—100	—150	—220	volts
D-C Plate Current	357	333	313	ma
D-C Grid Current*	94	90	93	ma
Peak R-F Grid Voltage (approx.)	345	395	470	volts
Driving Power*	29	32	39	watts
Grid Dissipation	20	19	18	watts
Plate Power Input	714	1000	1250	watts
Plate Dissipation	250	250	250	watts
Plate Power Output	464	750	1000	watts

PLATE MODULATED RADIO FREQUENCY POWER AMPLIFIER

Class-C Telephony (Carrier conditions)

MAXIMUM RATINGS, PER TUBE (Frequencies up to 40 Mc.)

D-C PLATE VOLTAGE	3200 MAX. VOLTS
D-C PLATE CURRENT	280 MAX. MA
PLATE DISSIPATION	165 MAX. WATTS
GRID DISSIPATION	40 MAX. WATTS

TYPICAL OPERATION, per tube[1] (Frequencies up to 40 Mc.)

D-C Plate Voltage	2000	2500	3000	volts
D-C Grid Voltage	—160	—180	—200	volts
D-C Plate Current	250	225	200	ma
D-C Grid Current*	60	45	38	ma
Peak R-F Grid Voltage	365	365	375	volts
Driving Power*	22	17	14	watts
Grid Dissipation*	12	8	6	watts
Plate Power Input	500	565	600	watts
Plate Dissipation	165	165	165	watts
Plate Power Output	335	400	435	watts

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class-AB_2 (Sinusoidal wave, two tubes unless otherwise specified)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	4000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT, PER TUBE	350 MAX. MA
MAX-SIGNAL PLATE DISSIPATION, PER TUBE	250 MAX. WATTS
MAX-SIGNAL GRID DISSIPATION	40 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	1500	2000	3000	volts
D-C Grid Voltage[1]	0	—30	—65	volts
Zero-Signal D-C Plate Current	220	140	100	ma
Max-Signal D-C Plate Current	700	700	560	ma
Effective Load, Plate-to-Plate	4200	6000	12,200	ohms
Peak A-F Grid Voltage (per tube)	230	260	260	volts
Max-Signal Peak Driving Power*	92	104	83	watts
Max-Signal Nominal Driving Power*	46	52	42	watts
Max Signal Plate Power Input	1050	1400	1680	watts
Max-Signal Plate Power Output	630	900	1180	watts

*Approximate values.

[1] Adjust to give stated Zero-Signal D-C Plate Current.

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER "TYPICAL OPERATION", POSSIBLY EXCEEDING THE MAXIMUM RATINGS GIVEN FOR CW SERVICE, WRITE EITEL-McCULLOUGH, INC., FOR INFORMATION AND RECOMMENDATIONS.

(Effective 5-1-53) Copyright 1953 by Eitel-McCullough, Inc.

APPLICATION

MECHANICAL

Mounting—The 250TH must be mounted vertically, base down or up. The plate and grid leads should be flexible, and the tube must be protected from vibration and shock.

Cooling—Heat Dissipating Connectors (Eimac HR-6 and HR-3 or equivalent) must be used at the plate and grid terminals of the 250TH. Forced-air cooling is not required in properly designed equipment operating at frequencies below 40 Mc. If the free circulation of air around the tube is restricted, a small fan or centrifugal blower should be used to provide additional cooling.

The temperature of the plate and grid seals must not be allowed to exceed 225° C. One method of measuring these temperatures is by the use of "Tempilaq," a temperature-sensitive lacquer manufactured by the Tempil Corporation, 132 W. 22nd St., New York 11, N. Y.

ELECTRICAL

Filament Voltage—The filament voltage, as measured directly at the tube, should be 5.0 volts with maximum allowable variations due to line fluctuations from 5.25 to 4.75 volts.

Bias Voltage—When grid-leak bias is used, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation, and the grid-leak resistor should be made adjustable to facilitate maintaining the bias voltage and plate current at the desired value from tube to tube.

Grid Dissipation—The power dissipated by the grid of the 250TH must not exceed 40 watts. Grid dissipation may be calculated from the following expression.

$$P_g = e_{cmp} I_c$$

where P_g = grid dissipation,
e_{cmp} = peak positive grid voltage, and
I_c = d-c grid current.

e_{cmp} may be measured by means of a suitable peak-reading voltmeter connected between filament and grid.[1] In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading.

Plate Dissipation—The plates of the 250TH operate at a visibly red color at the maximum rated dissipation of 250 watts. Plate dissipation in excess of the maximum rating is permissible only for short periods of time, such as during tuning procedures.

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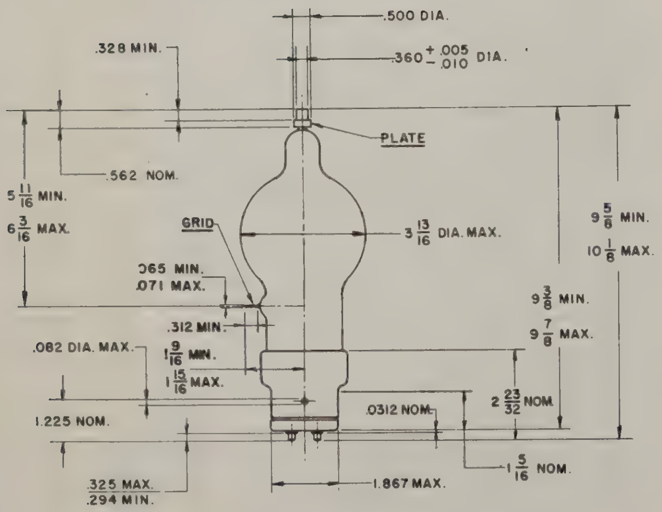
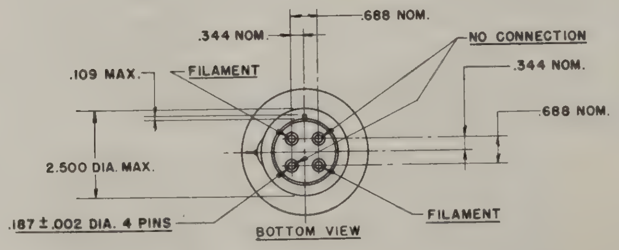
[1] For suitable peak v.t.v.m. circuits see, for instance, "Vacuum Tube Ratings," **Eimac News**, January, 1945. This article is available in reprint form on request.

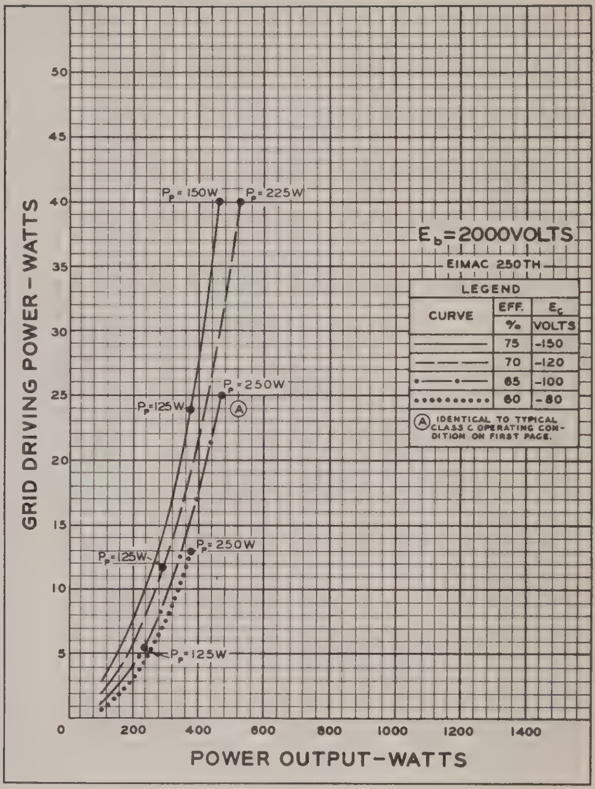


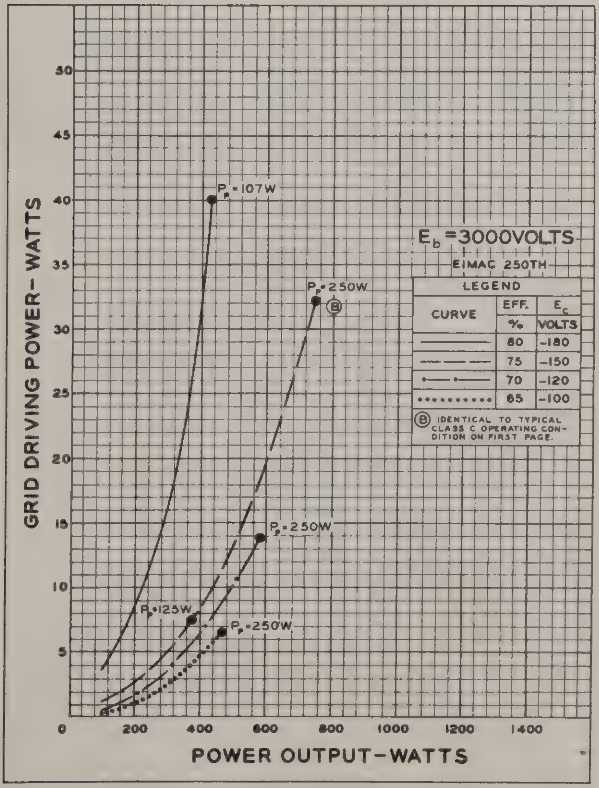


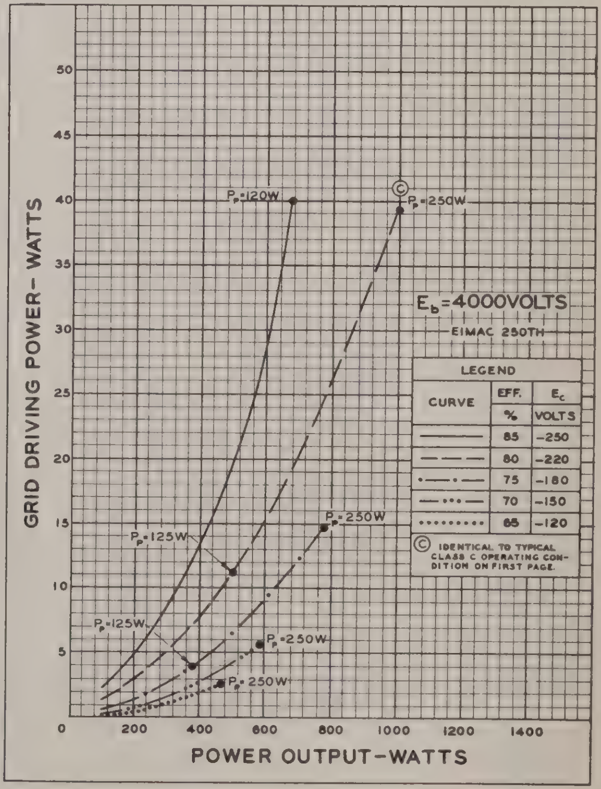
DIMENSIONS IN INCHES

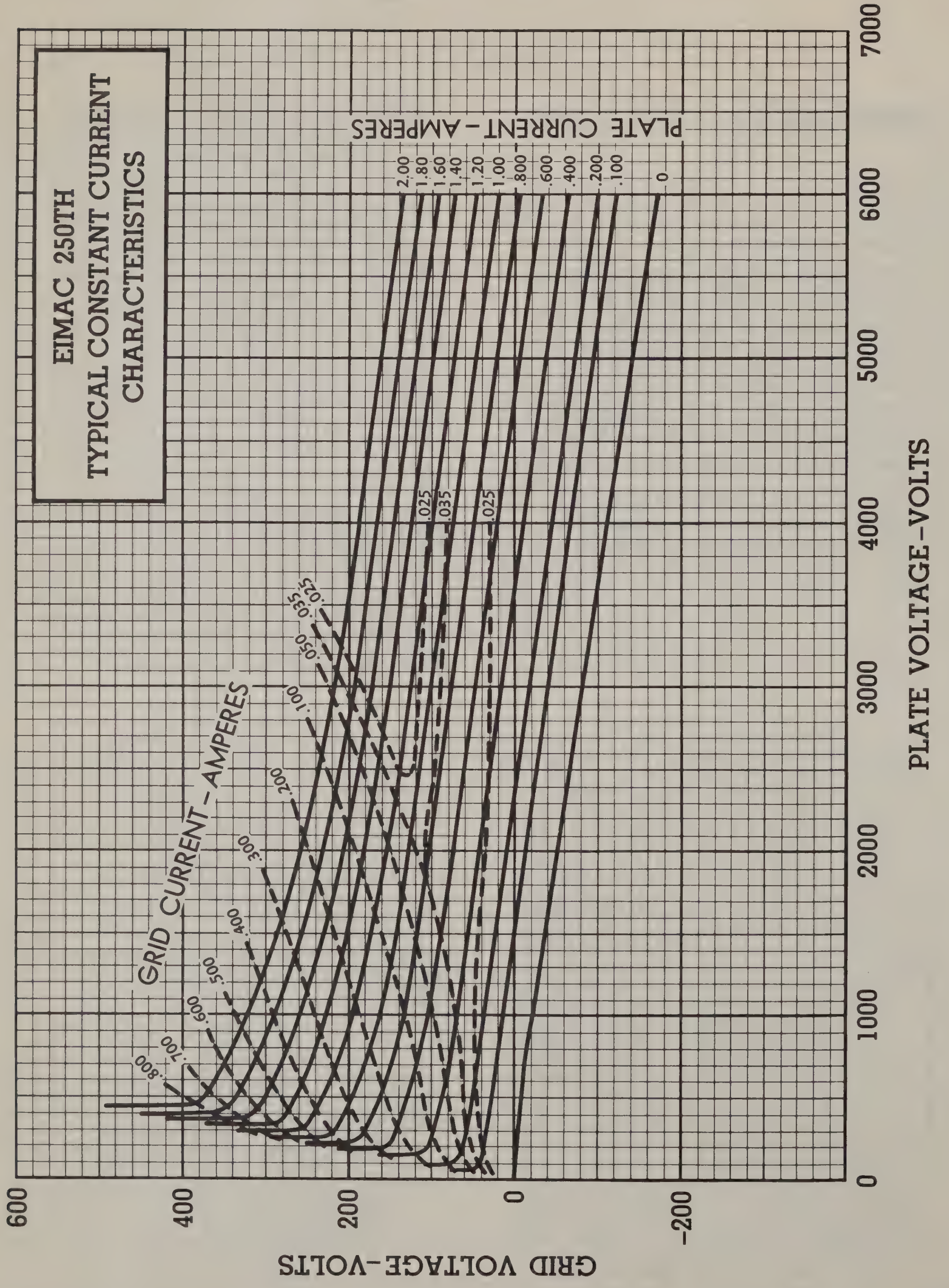
DRIVING POWER vs. POWER OUTPUT

The three charts on this page show the relationship of plate efficiency, power output and approximate grid driving power at plate voltages of 2000, 3000, and 4000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 2000, 3000, and 4000 volts respectively.









Indicates change from sheet dated 5-1-51.

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

250TL
LOW-MU TRIODE
•
MODULATOR
OSCILLATOR
AMPLIFIER

The Eimac 250TL is a low-mu triode having a maximum plate dissipation of 250 watts. It is intended for use as an amplifier, oscillator or modulator, and can be used at its maximum ratings at frequencies up to 40 Mc.

Cooling of the 250TL is accomplished by radiation from the plate, which operates at a visible red color at maximum dissipation, and by means of air circulation around the envelope.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated tungsten	
Voltage	5.0 volts
Current	10.5 amperes
Amplification Factor (Average)	14
Direct Interelectrode Capacitances (Average)	
Grid-Plate	3.0 $\mu\mu f$
Grid-Filament	3.7 $\mu\mu f$
Plate-Filament	0.7 $\mu\mu f$
▶ Transconductance ($i_b = 350$ ma., $E_b = 3000$V.)	2650 μmhos
Frequency for Maximum Ratings	40 Mc

MECHANICAL

Base: Medium 4-pin bayonet type, fits E. F. Johnson No. 211 series sockets, National XM-50 socket, or the equivalent.
For pin connections, see outline drawing.

Mounting	Vertical, base down or up.
Cooling	Convection and radiation.
Recommended Heat Dissipating Connectors:	
Plate	Eimac HR-6
Grid	Eimac HR-3
Maximum Overall Dimensions:	
Length	10.13 inches
Diameter	3.81 inches
Net Weight	10 ounces
Shipping Weight	3 pounds

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class-AB$_2$ (Sinusoidal wave, two tubes unless otherwise specified)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	3000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT, PER TUBE	350 MAX. MA.
MAX-SIGNAL PLATE DISSIPATION, PER TUBE	250 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	1500	2000	3000	Volts
D-C Grid Voltage (approx.)*	—40	—90	—170	Volts
Zero-Signal D-C Plate Current	200	150	100	Ma.
Max-Signal D-C Plate Current	700	650	500	Ma.
Effective Load, Plate-to-Plate	3800	6150	13,000	Ohms
Peak A-F Grid Input Voltage (per tube)	390	410	400	Volts
Max-Signal Peak Driving Power	76	74	32	Watts
Max-Signal Nominal Driving Power	38	37	16	Watts
Max-Signal Plate Power Output	580	800	1000	Watts

*Adjust for given zero-signal plate current.

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony
(Key-down conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	4000 MAX. VOLTS
D-C PLATE CURRENT	350 MAX. MA.
PLATE DISSIPATION	250 MAX. WATTS
GRID DISSIPATION	35 MAX. WATTS

TYPICAL OPERATION, per tube* (Frequencies up to 40 Mc.)

D-C Plate Voltage	2000	3000	4000	Volts
D-C Grid Voltage	—200	—350	—500	Volts
D-C Plate Current	350	335	310	Ma.
D-C Grid Current	45	45	40	Ma.
Peak R-F Grid Input Voltage (approx.)	575	720	900	Volts
Driving Power (approx.)	22	29	33	Watts
Grid Dissipation (approx.)	14	15	14	Watts
Power Input	700	1000	1250	Watts
Plate Dissipation	245	250	250	Watts
Plate Power Output	455	750	1000	Watts

*These figures show actual measured tube performance and do not allow for variations in circuit losses.

PLATE MODULATED RADIO FREQUENCY POWER AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	3200 MAX. VOLTS
D-C PLATE CURRENT	280 MAX. MA.
PLATE DISSIPATION	165 MAX. WATTS
GRID DISSIPATION	35 MAX. WATTS

TYPICAL OPERATION, per tube* (Frequencies up to 40 Mc.)

D-C Plate Voltage	2000	2500	3000	Volts
D-C Plate Current	250	225	200	Ma.
▶ Total D-C Bias Voltage	—520	—520	—520	Volts
Grid Resistor	13,000	15,000	17,500	Ohms
Fixed D-C Bias Supply Voltage	—140	—220	—266	Volts
D-C Grid Current	29	20	14	Ma.
Peak R-F Grid Input Voltage	840	795	795	Volts
Driving Power (approx.)	24	16	11	Watts
Grid Dissipation (approx.)	9	6	5	Watts
Plate Power Input	500	565	600	Watts
Plate Dissipation	165	165	165	Watts
Plate Power Output	335	400	435	Watts

*These figures show actual measured tube performance and do not allow for variations in circuit losses.

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER "TYPICAL OPERATION", POSSIBLY EXCEEDING THE MAXIMUM RATINGS GIVEN FOR CW SERVICE, WRITE EITEL-McCULLOUGH, INC. FOR INFORMATION AND RECOMMENDATIONS.

(Effective 8-20-53) Copyright, 1953 by Eitel-McCullough, Inc.

▶ Indicates change from sheet dated 4-1-51.

▶ APPLICATION

MECHANICAL

Mounting—The 250TL must be mounted vertically, base down or up. The plate and grid leads should be flexible, and the tube must be protected from vibration and shock.

Cooling—Heat Dissipating Connectors (Eimac HR-6 and HR-3 or equivalent) must be used at the plate and grid terminals of the 250TL. Forced-air cooling is not required in properly designed equipment operating at frequencies below 40 Mc. If the free circulation of air around the tube is restricted, a small fan or centrifugal blower should be used to provide additional cooling.

The temperature of the plate and grid seals must not be allowed to exceed 225° C. One method of measuring these temperatures is by the use of "Tempilaq," a temperature-sensitive lacquer manufactured by the Tempil Corporation, 132 W. 22nd St., New York 11, N. Y.

ELECTRICAL

Filament Voltage—The filament voltage, as measured directly at the tube, should be 5.0 volts with maximum allowable variations due to line fluctuations from 5.25 to 4.75 volts.

Bias Voltage—When grid-leak bias is used, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation, and the grid-leak resistor should be made adjustable to facilitate maintaining the bias voltage and plate current at the desired value from tube to tube.

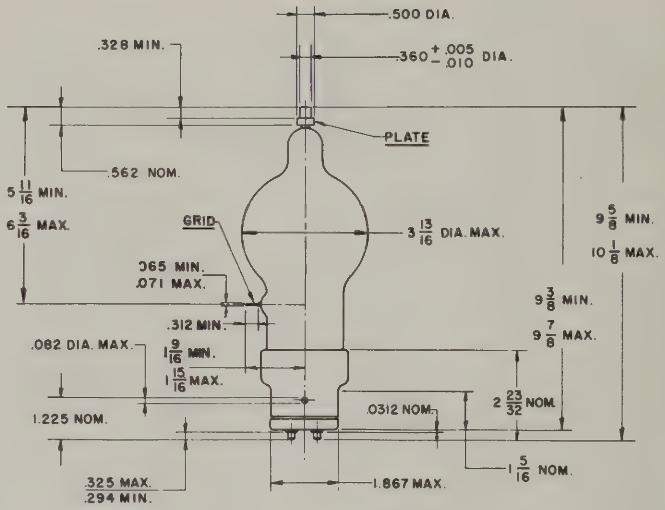
Grid Dissipation—The power dissipated by the grid of the 250TL must not exceed 40 watts. Grid dissipation may be calculated from the following expression.

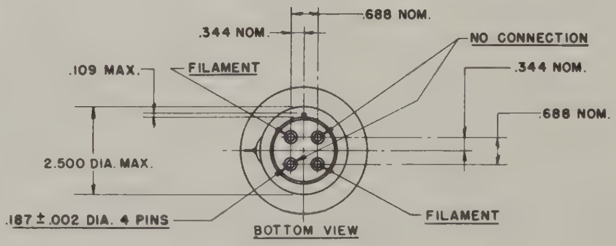
$$P_g = e_{cmp} I_c$$

where P_g = grid dissipation,
e_{cmp} = peak positive grid voltage, and
I_c = d-c grid current

e_{cmp} may be measured by means of a suitable peak-reading voltmeter connected between filament and grid.[1] In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading.

Plate Dissipation—The plates of the 250TL operate at a visibly red color at the maximum rated dissipation of 250 watts. Plate dissipation in excess of the maximum rating is permissible only for short periods of time, such as during tuning procedures.





DIMENSIONS IN INCHES

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[1] For suitable peak v.t.v.m. circuits see, for instance, "Vacuum Tube Ratings," **Eimac News**, January, 1945. This article is available in reprint form on request.

▶ Indicates change from sheet dated 4-1-51.

DRIVING POWER vs. POWER OUTPUT

◆

The three charts on this page show the relationship of plate efficiency, power output and approximate grid driving power at plate voltages of 2000, 3000 and 4000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by Pp.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 2000, 3000, and 4000 volts respectively.

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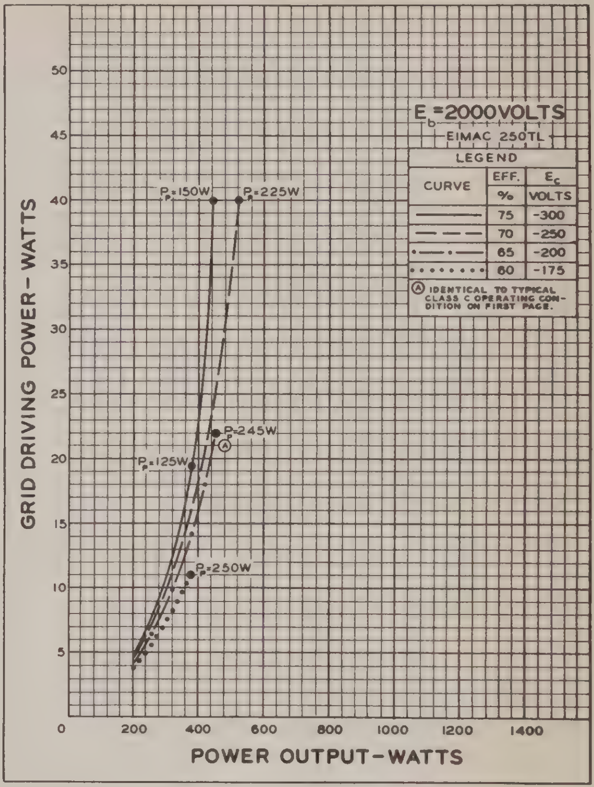

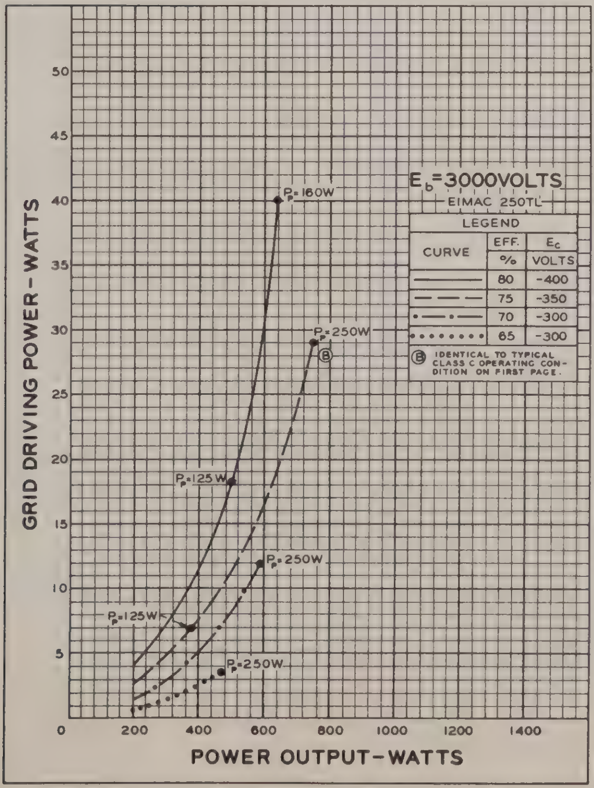

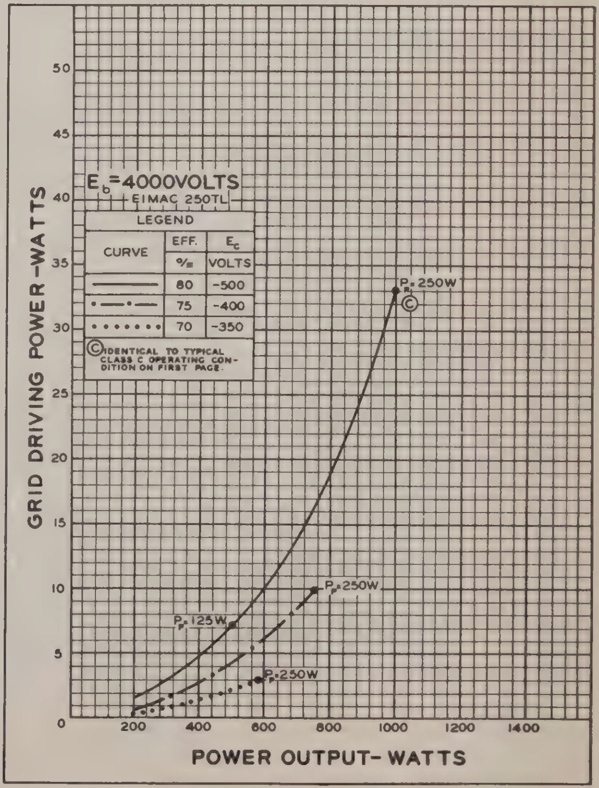

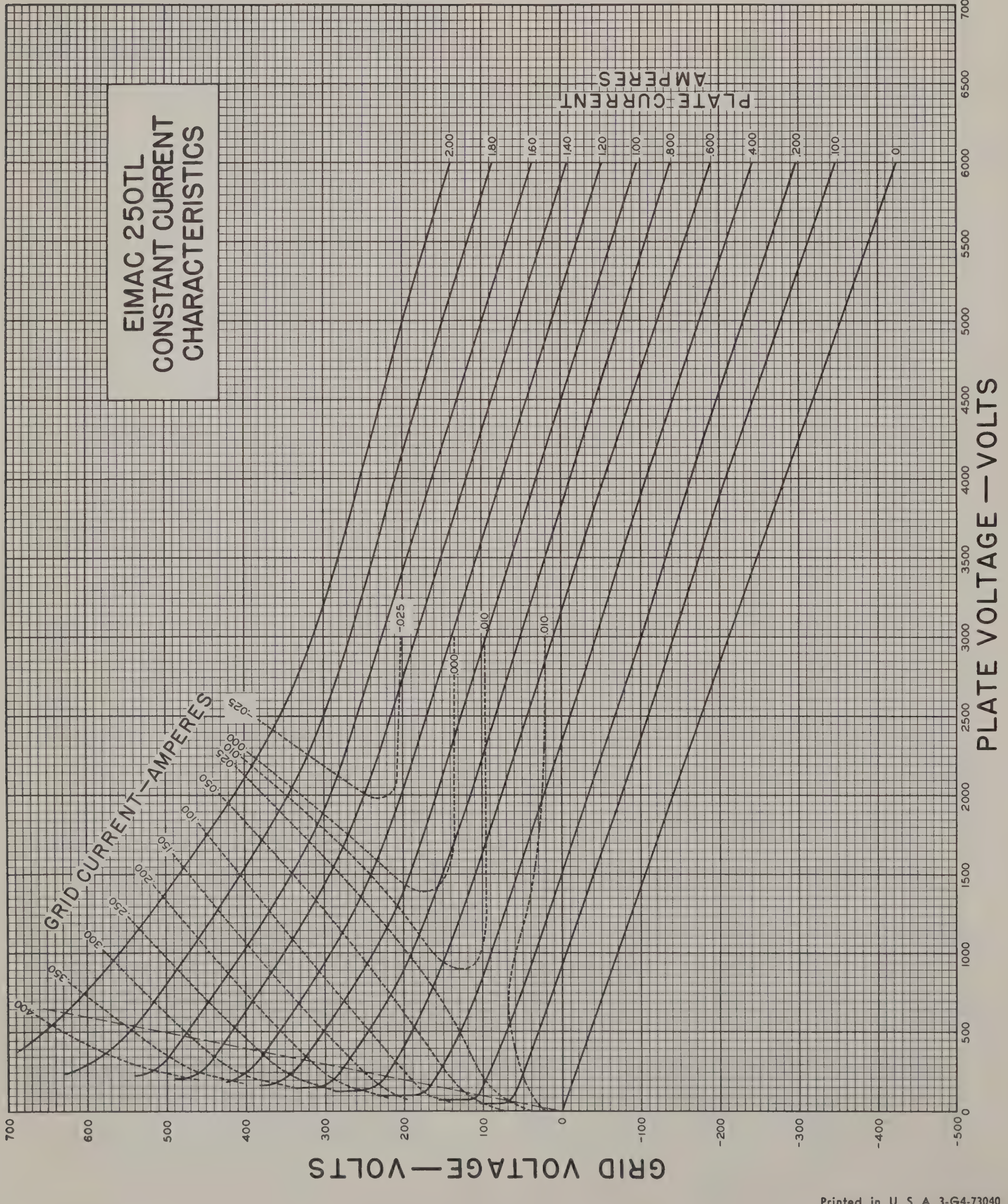

Printed in U. S. A. 3-G4-73040

EITEL-McCULLOUGH, INC.

SAN BRUNO, CALIFORNIA

304TH

MEDIUM-MU TRIODE

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MODULATOR
OSCILLATOR
AMPLIFIER

The Eimac 304TH is a medium-mu power triode intended for use as an amplifier, oscillator or modulator. It has a maximum plate-dissipation rating of 300 watts and a maximum plate-voltage rating of 3000 volts at frequencies up to 40 Mc.

The 304TH in class-C r-f service will deliver up to 1200 watts plate power output with 53 watts driving power. Two 304TH's in class-AB$_2$ modulator service will deliver up to 1400 watts maximum-signal plate power output with 14 watts nominal driving power.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten	
Voltage	5.0 or 10.0 volts
Current	25.0 or 12.5 amperes
Amplification Factor (Average)	20
Direct Interelectrode Capacitances (Average)	
Grid-Plate	10.2 $\mu\mu f$
Grid-Filament	13.5 $\mu\mu f$
Plate-Filament	0.7 $\mu\mu f$
Transconductance ($I_b = 1.0$ amp., $E_b = 3000$ v.)	16,700 μmhos
Highest Frequency for Maximum Ratings	40 Mc

MECHANICAL

Base	Special 4-pin
Basing	See outline drawing
Socket	Johnson type No. 124-213 or equivalent
Mounting Position	Vertical, base down or up
Cooling	Convection and radiation
Maximum Temperature of Plate and Grid Seals	225° C
Recommended Heat-Dissipating Connectors:	
Plate	Eimac HR-7
Grid	Eimac HR-6
Maximum Over-all Dimensions:	
Length	7.63 inches
Diameter	3.56 inches
Net Weight	9 ounces
Shipping Weight	3.0 pounds

RADIO-FREQUENCY POWER AMPLIFIER OR OSCILLATOR

Class-C Telegraphy (Key-down conditions, one tube)

MAXIMUM RATINGS (Frequencies up to 40 Mc.)

D-C PLATE VOLTAGE	3000 MAX. VOLTS
D-C PLATE CURRENT	900 MAX. MA
PLATE DISSIPATION	300 MAX. WATTS
GRID DISSIPATION	60 MAX. WATTS

TYPICAL OPERATION (Frequencies up to 40 Mc.)

D-C Plate Voltage	1500	2000	3000 volts
D-C Grid Voltage	—125	—200	—300 volts
D-C Plate Current	665	600	500 ma
D-C Grid Current*	115	125	135 ma
Peak R-F Grid Voltage	250	325	395 volts
Driving Power*	25	39	53 watts
Grid Dissipation*	16	12	16 watts
Plate Dissipation	300	300	300 watts
Plate Power Input	1000	1200	1500 watts
Plate Power Output	700	900	1200 watts

▶ PLATE-MODULATED RADIO-FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS (Frequencies up to 40 Mc.)

D-C PLATE VOLTAGE	2500 MAX. VOLTS
D-C PLATE CURRENT	750 MAX. MA
PLATE DISSIPATION	200 MAX. WATTS
GRID DISSIPATION	60 MAX. WATTS

TYPICAL OPERATION (Frequencies up to 40 Mc.)

D-C Plate Voltage	1500	2000	2500 volts
D-C Grid Voltage	—200	—300	—350 volts
D-C Plate Current	420	440	400 ma
D-C Grid Current*	55	60	60 ma
Peak R-F Grid Voltage	330	440	485 volts
Driving Power*	18	26	29 watts
Grid Dissipation*	7	8	8 watts
Plate Dissipation	200	200	200 watts
Plate Power Input	700	880	1000 watts
Plate Power Output	500	680	800 watts

▶ AUDIO-FREQUENCY POWER AMPLIFIER OR MODULATOR

Class-AB$_2$

MAXIMUM RATINGS (Per tube)

D-C PLATE VOLTAGE	3000 MAX. VOLTS
D-C PLATE CURRENT	900 MAX. MA
PLATE DISSIPATION	300 MAX. WATTS

TYPICAL OPERATION (Sinusoidal wave, two tubes unless otherwise specified.)

D-C Plate Voltage	1500	2000	3000 volts
D-C Grid Voltage[1]	—65	—90	—150 volts
Zero Signal D-C Plate Current	265	200	135 ma
Max. Signal D-C Plate Current	1065	900	665 ma
Effective Load Plate-to-Plate	2840	4820	10,200 ohms
Peak A-F Grid Voltage (per tube)	165	175	210 volts
Max. Signal Peak Driving Power*	50	37	27 watts
Max. Signal Nominal Driving Power*	25	19	14 watts
Max. Signal Plate Power Input	1600	1800	2000 watts
Max. Signal Plate Power Output	1000	1200	1400 watts

*Approximate values.

[1] Adjust to give stated Zero-Signal D-C Plate Current.

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER "TYPICAL OPERATION," POSSIBLY EXCEEDING THE MAXIMUM RATINGS GIVEN FOR CW SERVICE, WRITE EITEL-McCULLOUGH, INC., FOR INFORMATION AND RECOMMENDATIONS.

(Effective 4-10-53) Copyright 1953 by Eitel-McCullough, Inc.

▶ Indicates change from sheet dated 11-25-52.

APPLICATION

MECHANICAL

Mounting—The 304TH must be mounted vertically, base down or up. The plate and grid leads should be flexible, and the tube must be protected from vibration and shock.

Cooling—Heat Dissipating Connectors (Eimac HR-7 and HR-6 or equivalent) must be used at the plate and grid terminals of the 304TH. Forced-air cooling is not required in properly designed equipment operating at frequencies below 40 Mc. If the free circulation of air around the tube is restricted, a small fan or centrifugal blower should be used to provide additional cooling.

The temperature of the plate and grid seals must not be allowed to exceed 225° C. One method of measuring these temperatures is by the use of "Tempilaq," a temperature-sensitive lacquer manufactured by the Tempil Corporation, 132 W. 22nd St., New York 11, N. Y.

ELECTRICAL

Filament Voltage—The filaments of the 304TH may be operated either at 10.0 volts when connected in series or at 5.0 volts when connected in parallel (see basing diagram). For maximum tube life the filament voltage should be maintained at the rated value. Variations must not be allowed to exceed ± 5%.

Bias Voltage—When grid-leak bias is used, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation, and the grid-leak resistor should be made adjustable to facilitate maintaining the bias voltage and plate current at the desired value from tube to tube.

Grid Dissipation—The power dissipated by the grid of the 304TH must not exceed 60 watts. Grid dissipation may be calculated from the following expression.

$$P_g = e_{cmp} I_c$$

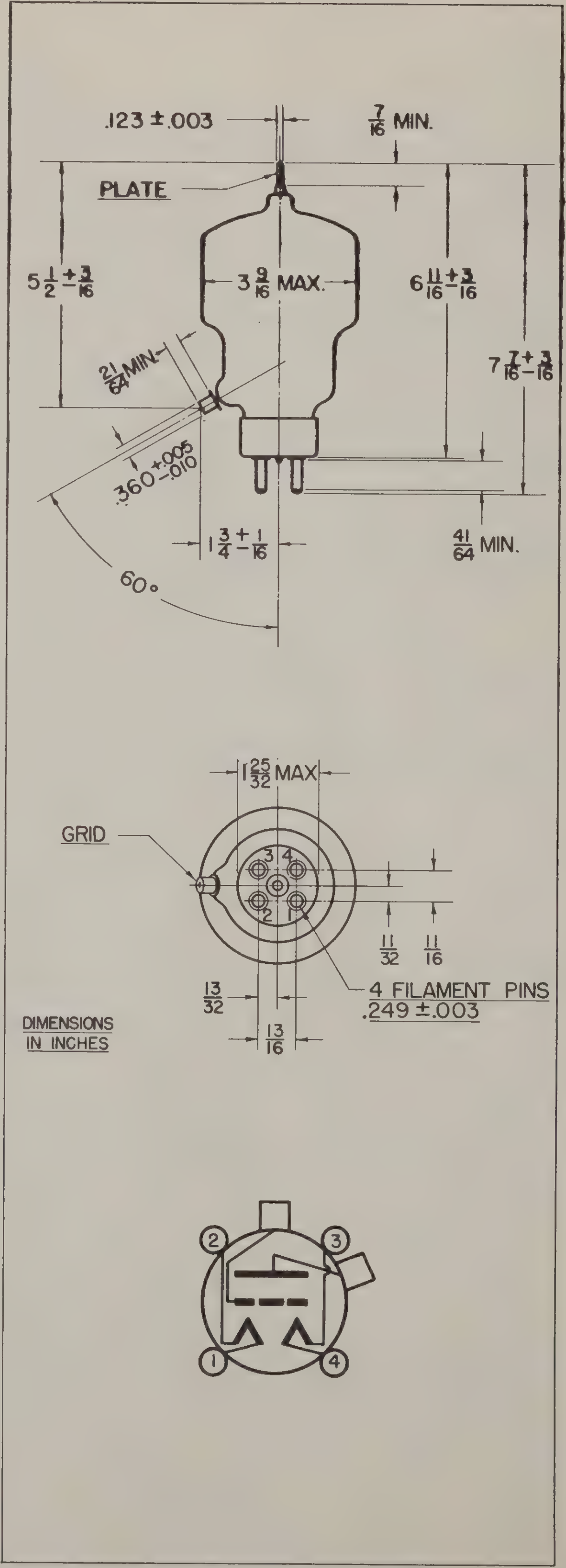
where P_g = grid dissipation,

e_{cmp} = peak positive grid voltage, and

I_c = d-c grid current.

e_{cmp} may be measured by means of a suitable peak-reading voltmeter connected between filament and grid.[1] In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading.

Plate Dissipation—The plates of the 304TH operate at a visible red color at the maximum rated dissipation of 300 watts. Plate dissipation in excess of the maximum rating is permissible only for short periods of time, such as during tuning procedures.



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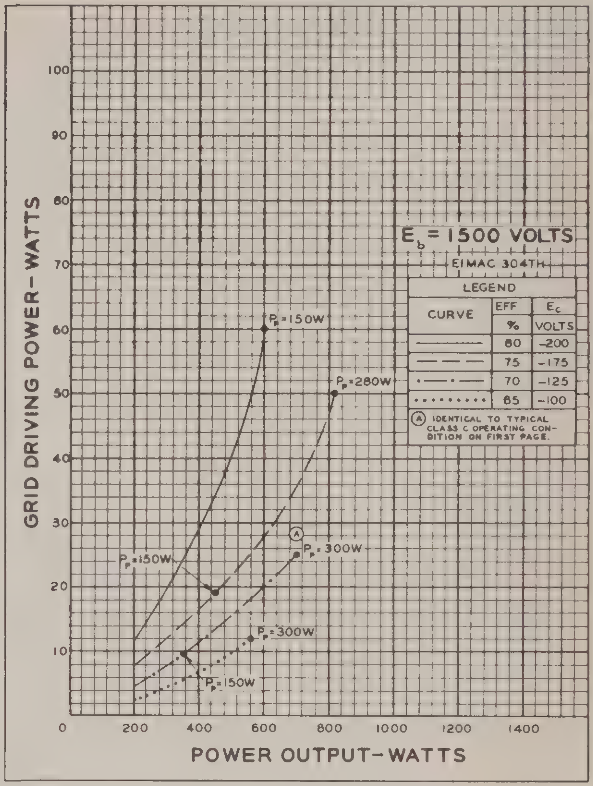
[1] For suitable peak v.t.v.m. circuits see, for instance, "Vacuum Tube Ratings," **Eimac News,** January, 1945. This article is available in reprint form on request.

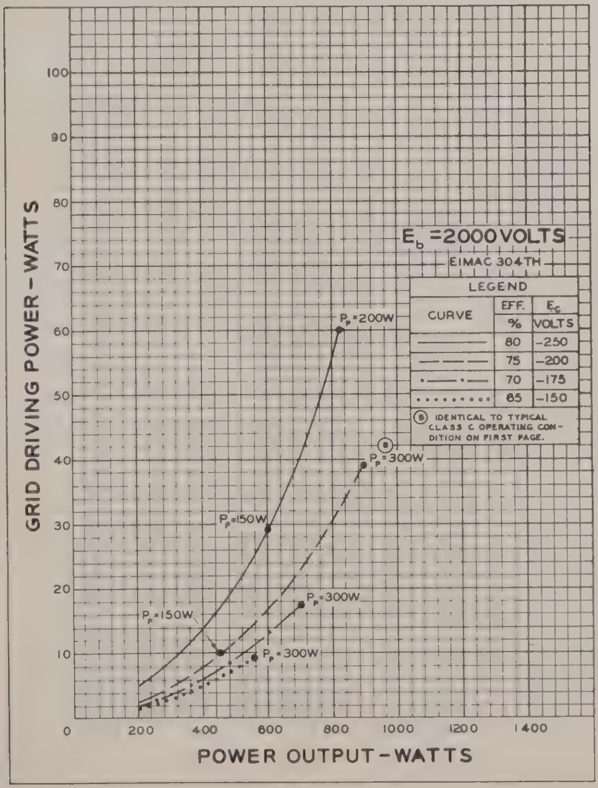
DRIVING POWER vs. POWER OUTPUT

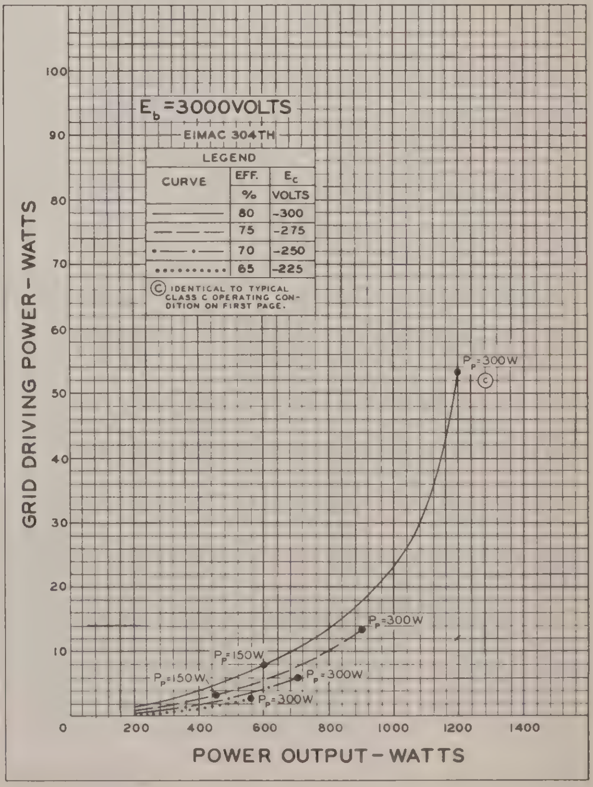
•

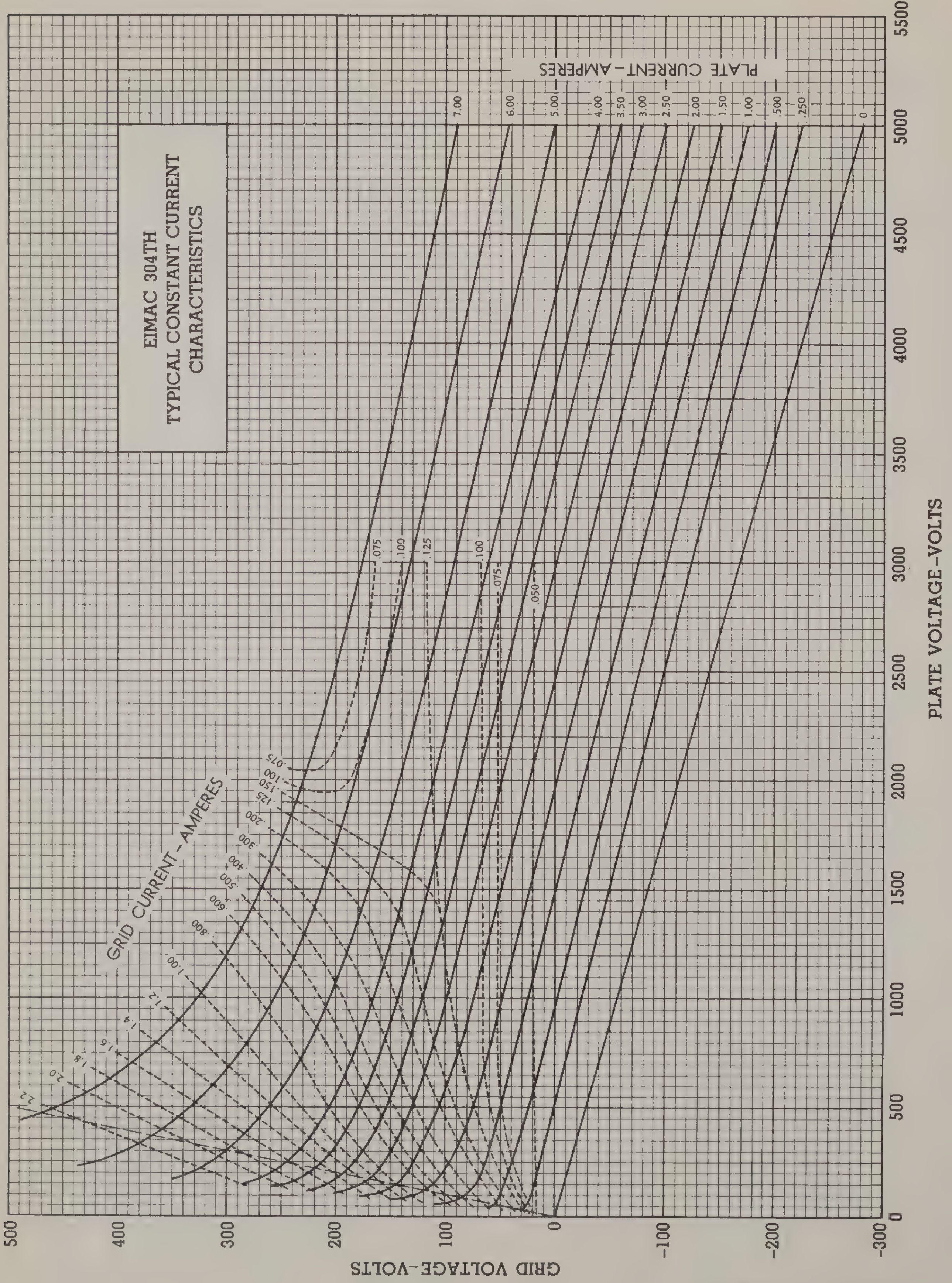
The three charts on this page show the relationship of plate efficiency, power output and approximate grid driving power at plate voltages of 1500, 2000 and 3000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by Pp.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 1500, 2000, and 3000 volts respectively.








EIMAC 304TH
TYPICAL CONSTANT CURRENT
CHARACTERISTICS
PLATE CURRENT – AMPERES
7.00
6.00
5.00
4.00
3.50
3.00
2.50
2.00
1.50
1.00
.500
.250
0
GRID CURRENT – AMPERES
.075
.100
.150
.125
.200
.300
.400
.500
.600
.800
1.00
1.2
1.4
1.6
1.8
2.0
2.2
.075
.100
.125
.100
.075
.050
PLATE VOLTAGE-VOLTS
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
GRID VOLTAGE-VOLTS
500
400
300
200
100
0
-100
-200
-300

Eimac®

EITEL-McCULLOUGH, INC.
SAN CARLOS · CALIFORNIA

304TL

LOW-MU TRIODE

MODULATOR
OSCILLATOR
AMPLIFIER

The Eimac 304TL is a low-mu, power triode having a maximum plate dissipation rating of 300 watts, and is intended for use as an amplifier, oscillator or modulator, where maximum performance can be obtained at low plate voltage. It can be used at its maximum ratings at frequencies as high as 40-Mc.

Cooling of the 304TL is accomplished by radiation from the plate, which operates at a visible red color at maximum dissipation, and by means of air convection around the envelope.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated tungsten	
Voltage	5.0 or 10.0 volts
Current	25.0 or 12.5 amperes
Amplification Factor (Average)	12
Direct Interelectrode Capacitances (Average)	
Grid-Plate	8.6 μμf
Grid-Filament	12.1 μμf
Plate-Filament	.8 μμf
Transconductance ($i_b = 1.0$ amp., $E_b = 3000$ v, $e_c = -175$v.)	16,700 μmhos
Frequency for Maximum Ratings	40 Mc.

MECHANICAL

Base	Special 4 pin, No. 5000B
Basing	RMA type 4BC
Mounting	Vertical, base down or up
Cooling	Convection and Radiation
Recommended Heat Dissipating Connectors:	
Plate	HR-7
Grid	HR-6
Maximum Overall Dimensions:	
Length	7.625 inches
Diameter	3.563 inches
Net weight	9 ounces
Shipping weight (Average)	2 pounds

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class B (Sinusoidal wave, two tubes unless otherwise specified)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	3000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT, PER TUBE	900 MAX. MA.
PLATE DISSIPATION, PER TUBE	300 MAX. WATTS

TYPICAL OPERATION, CLASS AB_1

D-C Plate Voltage	1500	2000	2500	3000	Volts
D-C Grid Voltage (approx.)*	—118	—170	—230	—290	Volts
Zero-Signal D-C Plate Current	270	200	160	130	Ma.
Max-Signal D-C Plate Current	572	546	483	444	Ma.
Effective Load, Plate-to-Plate	2540	5300	8500	12,000	Ohms
Peak A-F Grid Input Voltage (per tube)	118	170	230	290	Volts
Max-Signal Peak Driving Power	0	0	0	0	Watts
Max-Signal Plate Power Output	256	490	610	730	Watts

*Adjust to give stated zero-signal plate current. The effective grid circuit resistance for each tube must not exceed 250,000 ohms.

TYPICAL OPERATION, CLASS AB_2

D-C Plate Voltage	1500	2000	2500	3000	Volts
D-C Grid Voltage (approx.)*	—118	—170	—230	—290	Volts
Zero-Signal D-C Plate Current	270	200	160	130	Ma.
Max-Signal D-C Plate Current	1140	1000	900	800	Ma.
Effective Load, Plate-to-Plate	2750	4500	6600	9100	Ohms
Peak A-F Grid Input Voltage (per tube)	245	290	340	390	Volts
Max-Signal Peak Driving Power	78	87	95	110	Watts
Max-Signal Nominal Driving Power (approx.)	39	44	48	55	Watts
Max-Signal Plate Power Output	1100	1400	1650	1800	Watts

*Adjust to give stated zero-signal plate current.

PLATE MODULATED RADIO FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	2500 MAX. VOLTS
D-C PLATE CURRENT	700 MAX. MA.
PLATE DISSIPATION	200 MAX. WATTS
GRID DISSIPATION	50 MAX. WATTS

TYPICAL OPERATION (Power input limited to 500 and 1000 watts)*

D-C Plate Voltage	2000	2000	2500	2500	Volts
D-C Plate Current	250	500	200	400	Ma.
Total Bias Voltage	—500	—500	—525	—550	Volts
Fixed Bias Voltage	—410	—275	—300	—300	Volts
Grid Resistor	3000	3000	12,500	5000	Ohms
D-C Grid Current	30	75	18	50	Ma.
Peak R-F Grid Input Voltage	615	690	620	715	Volts
Driving Power	18	52	11	36	Watts
Grid Dissipation	3	15	2	9	Watts
Plate Power Input	500	1000	500	1000	Watts
Plate Dissipation	90	190	75	170	Watts
Plate Power Output	410	810	425	830	Watts

*The figures are for convenience in obtaining a 500 or 1000 Watt carrier input per tube to the modulated amplifier. The output figures do not allow for circuit losses.

TYPICAL OPERATION*

D-C Plate Voltage	1500	2000	2500	Volts
D-C Plate Current	520	525	450	Ma.
Total Bias Voltage	—370	—500	—550	Volts
Fixed Bias Voltage	—160	—260	—440	Volts
Grid Resistor	2800	3000	2000	Ohms
D-C Grid Current	75	80	55	Ma.
Peak R-F Grid Input Voltage	545	695	720	Volts
Driving Power	41	55	40	Watts
Grid Dissipation	13	15	10	Watts
Plate Power Input	780	1050	1125	Watts
Plate Dissipation	200	200	200	Watts
Power Output	580	850	925	Watts

*The figures are for one tube operating at maximum plate dissipation as a plate modulated Class C amplifier. The output figures do not allow for circuit losses.

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RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony
(Key-down conditions, per tube)

MAXIMUM RATINGS

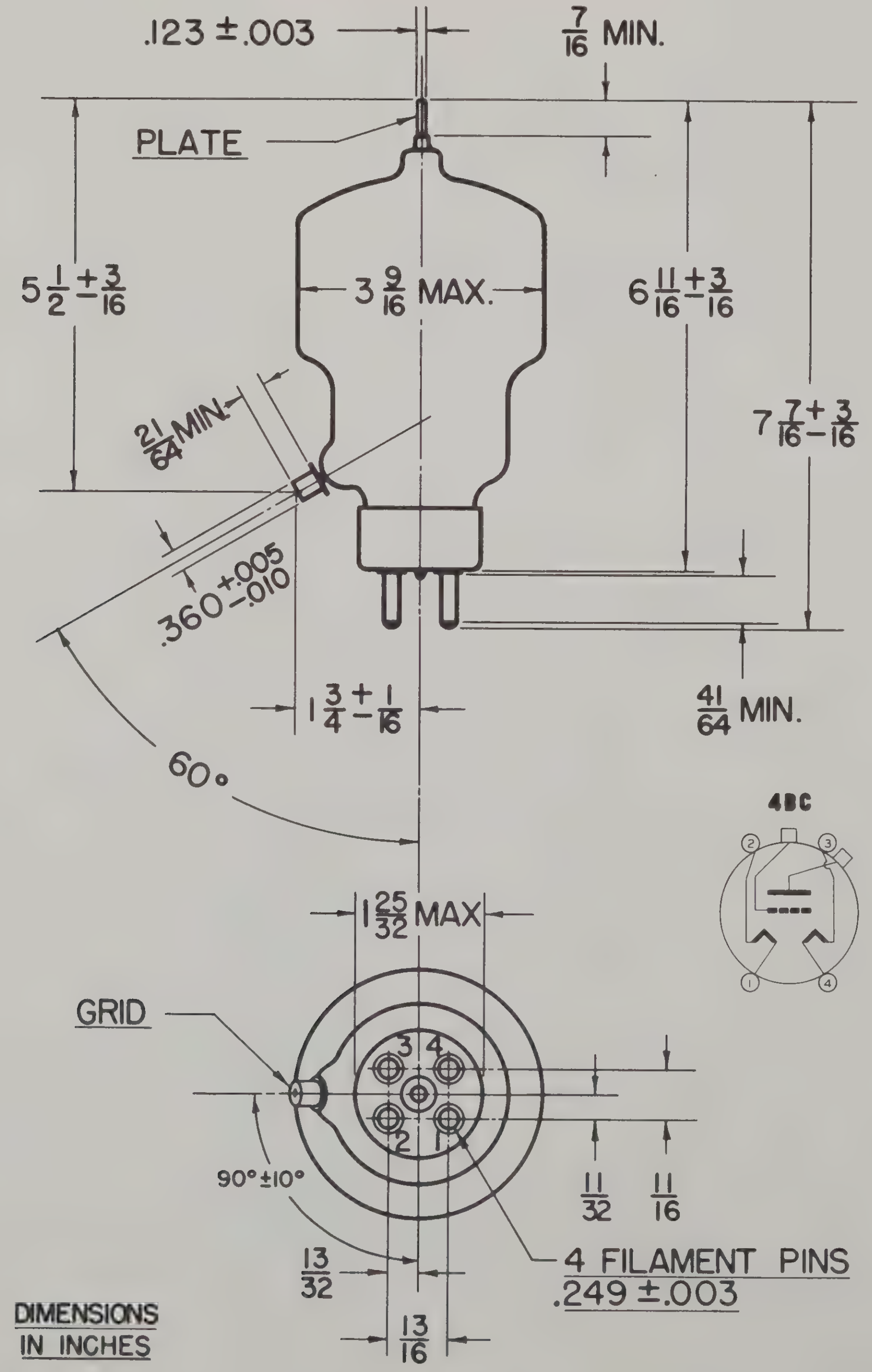
D-C PLATE VOLTAGE	3000 MAX. VOLTS
D-C PLATE CURRENT	900 MAX. MA.
PLATE DISSIPATION	300 MAX. WATTS
GRID DISSIPATION	50 MAX. WATTS

TYPICAL OPERATION*

D-C Plate Voltage	1500	2000	3000	Volts
D-C Grid Voltage	—250	—300	—400	Volts
D-C Plate Current	665	600	500	Ma.
D-C Grid Current	90	85	80	Ma.
Peak R-F Grid Input Voltage	430	480	575	Volts
Driving Power (approx.)	33	36	40	Watts
Grid Dissipation	11	11	8	Watts
Plate Power Input	1000	1200	1500	Watts
Plate Dissipation	300	300	300	Watts
Plate Power Output	700	900	1200	Watts

*The figures show actual measured tube performance, and do not allow for circuit losses.

▶

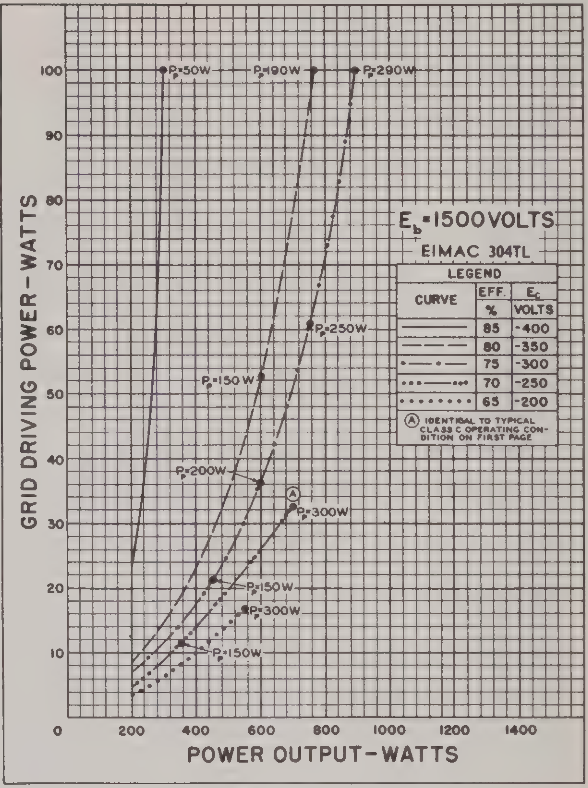


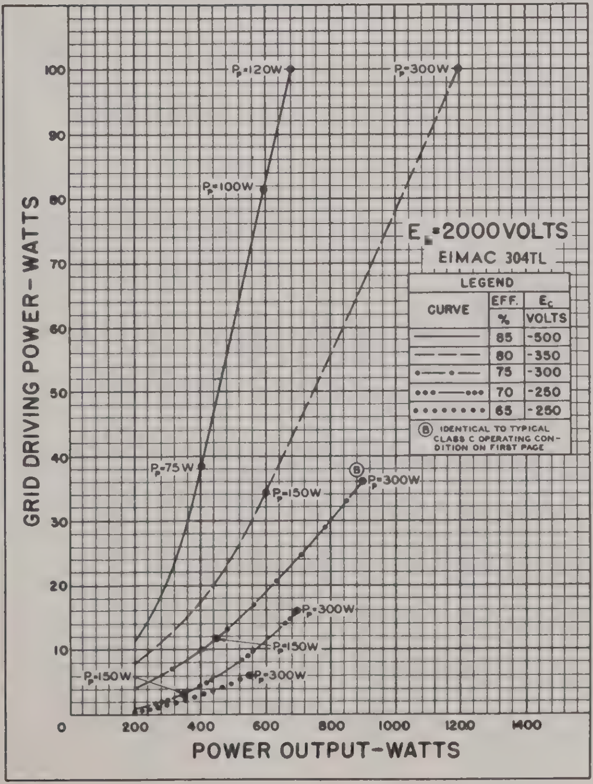
▶ Indicates change from sheet dated 5-1-49

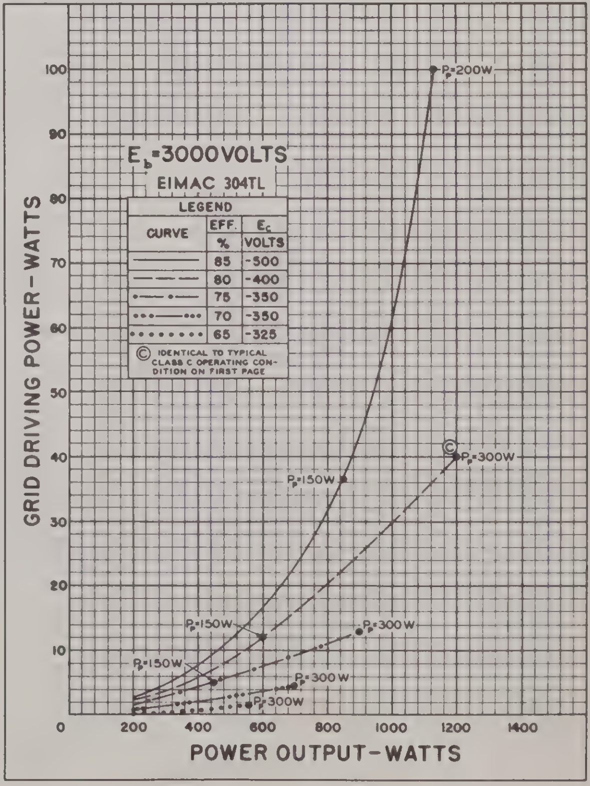
DRIVING POWER vs. POWER OUTPUT

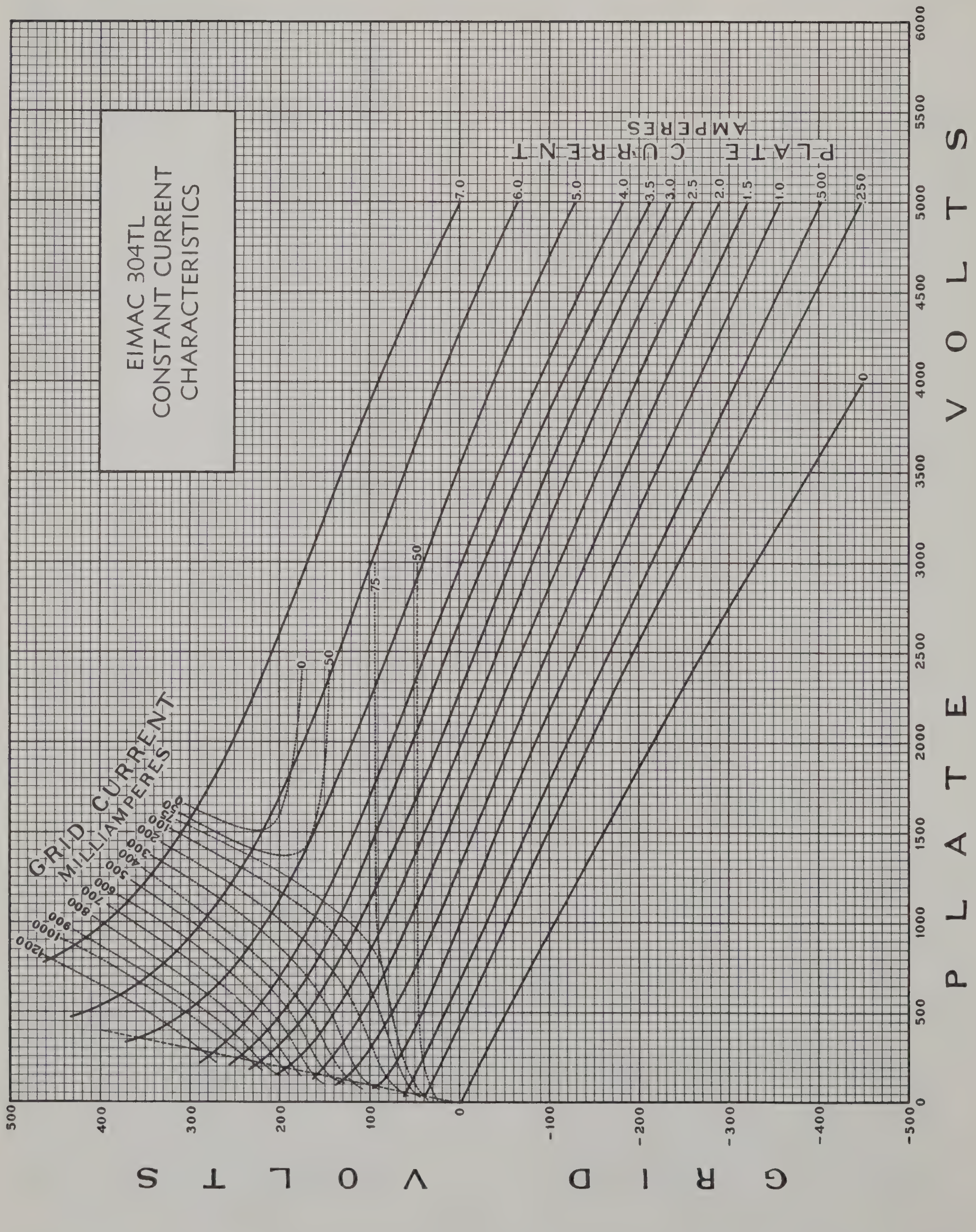
The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 1500, 2000 and 3000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 1500, 2000, and 3000 volts respectively.









Printed in U.S.A. 50847

EITEL-McCULLOUGH, INC.

SAN BRUNO, CALIFORNIA

450TH

HIGH-MU TRIODE

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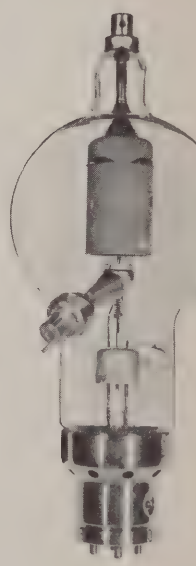
MODULATOR
OSCILLATOR
AMPLIFIER



The Eimac 450TH is a high-mu power triode having a maximum plate dissipation rating of 450 watts, and is intended for use as an amplifer, oscillator and modulator. It can be used at its maximum ratings at frequencies as high as 40 Mc.

Cooling of the 450TH is accomplished by radiation from the plate, which operates at a visible red color at maximum dissipaton, and by means of air circulation around the envelope.

GENERAL CHARACTERISTICS

▶ ELECTRICAL

Filament: Thoriated tungsten

Voltage	7.5 volts
Current	12.0 amperes

Note: Dual connections for each filament lead are provided within the base of the tube (see basing diagram). Corresponding socket terminals must be connected in parallel to provide proper distribution of filament and R-F charging currents.

Amplification Factor (Average)	38
Direct Interelectrode Capacitances (Average)	
Grid-plate	5.0 μμfd.
Grid-Filament	8.8 μμfd.
Plate-Filament	0.8 μμfd.
Transconductance (i_b=500 ma., E_b=4000 v.)	6650 μmhos
Frequency for maximum ratings	40 Mc.

▶ MECHANICAL

Base	Special 4 pin, No. 5002B
Basing	RMA type 4AQ
Mounting	Vertical, base down or up
Cooling	Radiation and air circulation

Note: Adequate ventilation or air cooling must be provided so that the seals and envelope do not exceed 200°C under operating conditions.

Socket	Johnson Type No. 211 or National Type No. XM50 or equivalent.
Recommended Heat Dissipating Connectors:	
Plate	Eimac HR-8
Grid	Eimac HR-8

Note: The grid terminal of the 450TH is now .560" in diameter. To accommodate existing equipment designed for the older style 450TH having .098" diameter grid terminals, an adapter pin is provided with the newer tubes. This adapter pin is threaded so that it may be removed from the grid terminal of the tube. The small grid terminal, if used, requires an HR-4 heat dissipating connector. (See outline drawing.)

Maximum Overall Dimensions:	
Length	12.625 inches
Diameter	5.125 inches
Net weight	1.3 pounds
Shipping weight (Average)	5.6 pounds

▶ AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class AB$_2$ (Sinusoidal wave, two tubes unless otherwise specified)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	6000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT PER TUBE	600 MAX. MA.
PLATE DISSIPATION, PER TUBE	450 MAX. WATTS

TYPICAL OPERATION—2 TUBES

D-C Plate Voltage	3000	4000	5000	Volts
D-C Grid Voltage (approx.)*	—50	—85	—115	Volts
Zero-Signal D-C Plate Current	200	150	120	Ma.
Max-Signal D-C Plate Current	770	675	620	Ma.
Effective Load, Plate-to-Plate	7800	12,800	18,600	Ohms
Peak A-F Grid Input Voltage (per tube)	225	235	267	Volts
Max-Signal Peak Driving Power	40	34	40	Watts
Max-Signal Nominal Driving Power (approx.)	20	17	20	Watts
Max-Signal Plate Power Output	1400	1800	2200	Watts

*Adjust to give stated zero-signal plate current.

▶ PLATE MODULATED RADIO FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	4500 MAX. VOLTS
D-C PLATE CURRENT	500 MAX. MA.
PLATE DISSIPATION	300 MAX. WATTS
GRID DISSIPATION	80 MAX. WATTS

TYPICAL OPERATION, PER TUBE*

D-C Plate Voltage	3000	4000	4500	Volts
D-C Plate Current	380	340	345	Ma.
Total Bias Voltage	—250	—300	—350	Volts
Fixed Bias Voltage	—100	—150	—175	Volts
Grid Resistor	2500	3500	3500	Ohms
D-C Grid Current	60	43	50	Ma.
Peak R-F Grid Input Voltage	490	525	585	Volts
Driving Power (approx.)	30	23	29	Watts
Grid Dissipation	14	10	12	Watts
Plate Power Input	1150	1360	1550	Watts
Plate Dissipation	300	300	300	Watts
Plate Power Output	850	1060	1250	Watts

*The figures are for one tube operating at maximum plate dissipation as a plate modulated Class-C amplifier. The output figures do not allow for circuit losses.

(Effective 8-1-50) Copyright, 1946 by Eitel Mc-Cullough, Inc.

▶ Indicates change from sheet dated 10-1-49.

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony (Key-down conditions, per tube).

MAXIMUM RATINGS

D-C PLATE VOLTAGE	6000 MAX. VOLTS
D-C PLATE CURRENT	600 MAX. MA.
PLATE DISSIPATION	450 MAX. WATTS
GRID DISSIPATION	80 MAX. WATTS

TYPICAL OPERATION, PER TUBE*

D-C Plate Voltage	3000	4000	5000	Volts
D-C Grid Voltage	—175	—200	—300	Volts
D-C Plate Current	500	450	450	Ma.
D-C Grid Current	95	85	90	Ma.
Peak R-F Grid Input Voltage	400	410	570	Volts
Driving Power (approx.)	35	35	46	Watts
Grid Dissipation	21	18	24	Watts
Plate Power Input	1500	1800	2250	Watts
Plate Dissipation	450	450	450	Watts
Plate Power Output	1050	1350	1800	Watts

*The figures show actual measured tube performance and do not allow for circuit losses.

APPLICATION

MECHANICAL

Mounting—The 450TH must be mounted vertically, base up or base down. Flexible connecting straps should be provided from the grid and plate terminals to the external grid and plate circuits. The tube must be protected from severe vibration and shock.

Cooling—Provision should be made for ample circulation of air around the 450TH. In the event that the design of the equipment restricts natural circulation, the use of a small fan or centrifugal blower to provide additional cooling for the tube will aid in obtaining maximum tube life. Special heat-dissipating connectors (Eimac HR-8) are available for use on the plate and grid terminals. These connectors help to prolong tube life by reducing the temperature of the seals.

ELECTRICAL

Filament Voltage—For maximum tube life the filament voltage, as measured directly at the filament pins, should be the rated value of 7.5 volts. Unavoidable variations in fialment voltage must be kept within the range from 7.03 to 7.88 volts. All four socket terminals should be used, putting two in parallel for each filament connection.

Bias Voltage—Although there is no maximum limit on the bias voltage which may be used on the 450TH, there is little advantage in using bias voltages in excess of those given under "Typical Operation," except in certain very specialized applications. Where bias is obtained by a grid leak, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation.

Grid Dissipation—The power dissipated by the grid of the 450TH must not exceed 80 watts. Grid dissipation may be calculated from the following expression:

$$P_g = e_{cpm} I_c$$

where P_g = Grid dissipation,

e_{cmp} = Peak positive grid voltage, and

I_c = D-c grid current.

e_{cmp} may be measured by means of a suitable peak voltmeter connected between filament and grid.[1] In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any conditions of loading.

Plate Voltage—Except in very special applications, the plate supply voltage for the 450TH should not exceed 6000 volts. In most cases there is little advantage in using plate-supply voltages higher than those given under "Typical Operation" for the power output desired.

Plate Dissipation—Under normal operating conditions, the power dissipated by the plate of the 450TH should not be allowed to exceed 450 watts. At this dissipation the brightness temperature of the plate will appear a visible red color. The value of this color is somewhat effected by light from the filament as well as from external sources. Plate dissipation in excess of the maximum rating is permissible for short periods of time, such as during tuning procedures.

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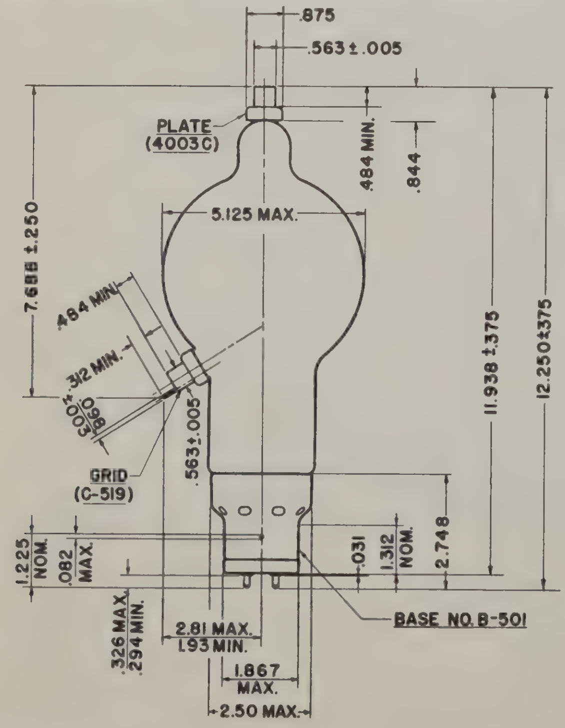
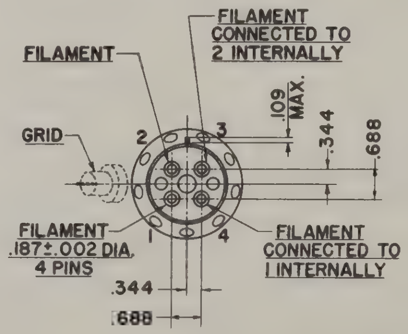
[1] For suitable peak v.t.v.m. circuits see, for instance, "Vacuum Tube Ratings," **Eimac News**, January, 1945. This article is available in reprint form on request.




FILAMENT
FILAMENT CONNECTED TO 2 INTERNALLY
GRID
2
3
.109 MAX.
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FILAMENT CONNECTED TO 1 INTERNALLY
.344
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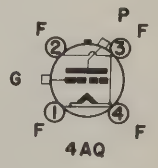
BOTTOM VIEW



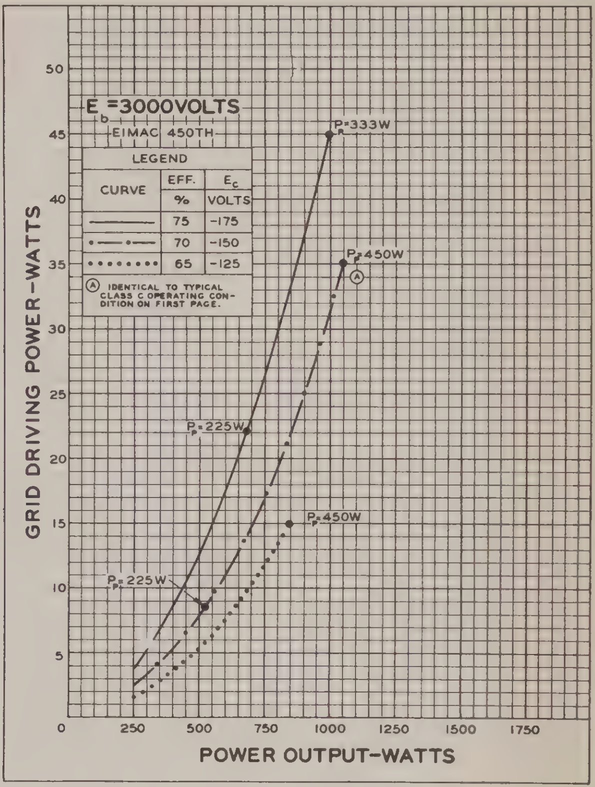
NOTE:—The grid terminal on the new 450TH and TL type tube is now .563" in diameter. To accommodate existing equipment which uses the 450TH or TL tubes with the old style .098" grid terminal, an adapter pin is provided. This adapter pin, if not needed, may be removed by unscrewing.

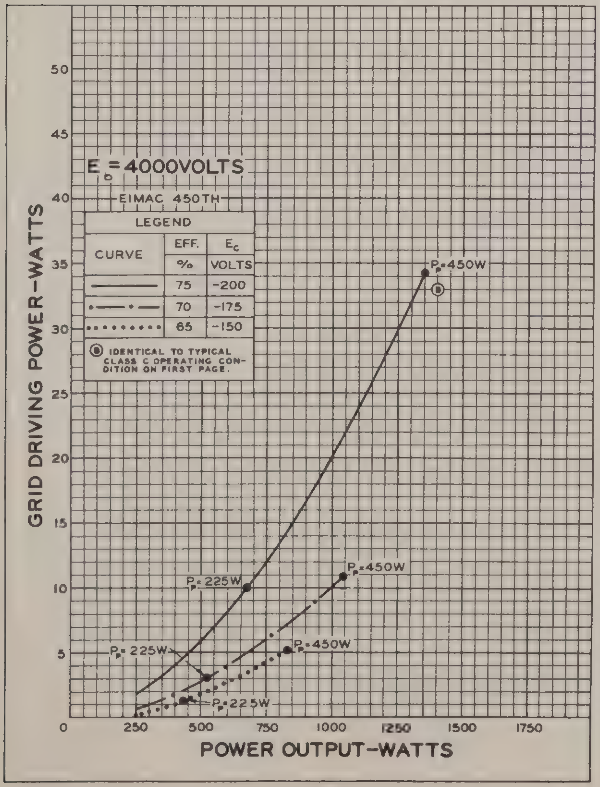
▶ Indicates change from sheet dated 10-1-49

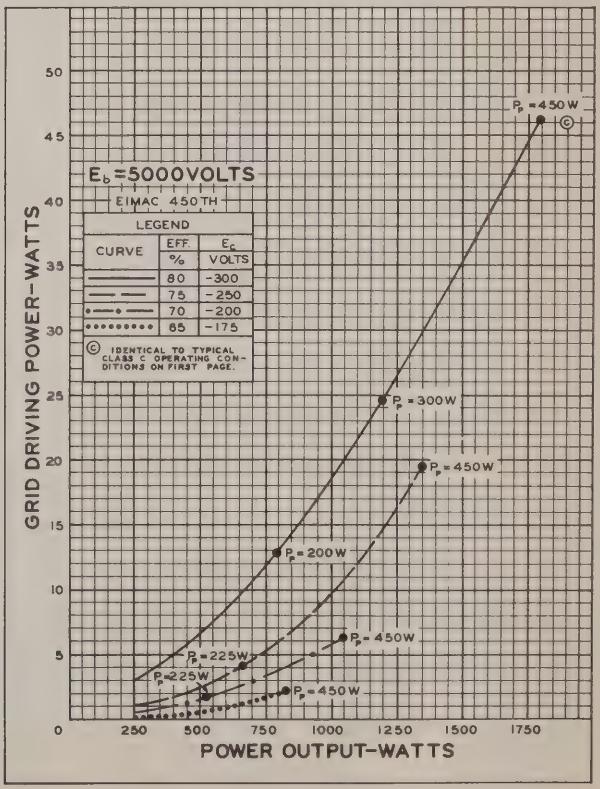
DRIVING POWER vs. POWER OUTPUT

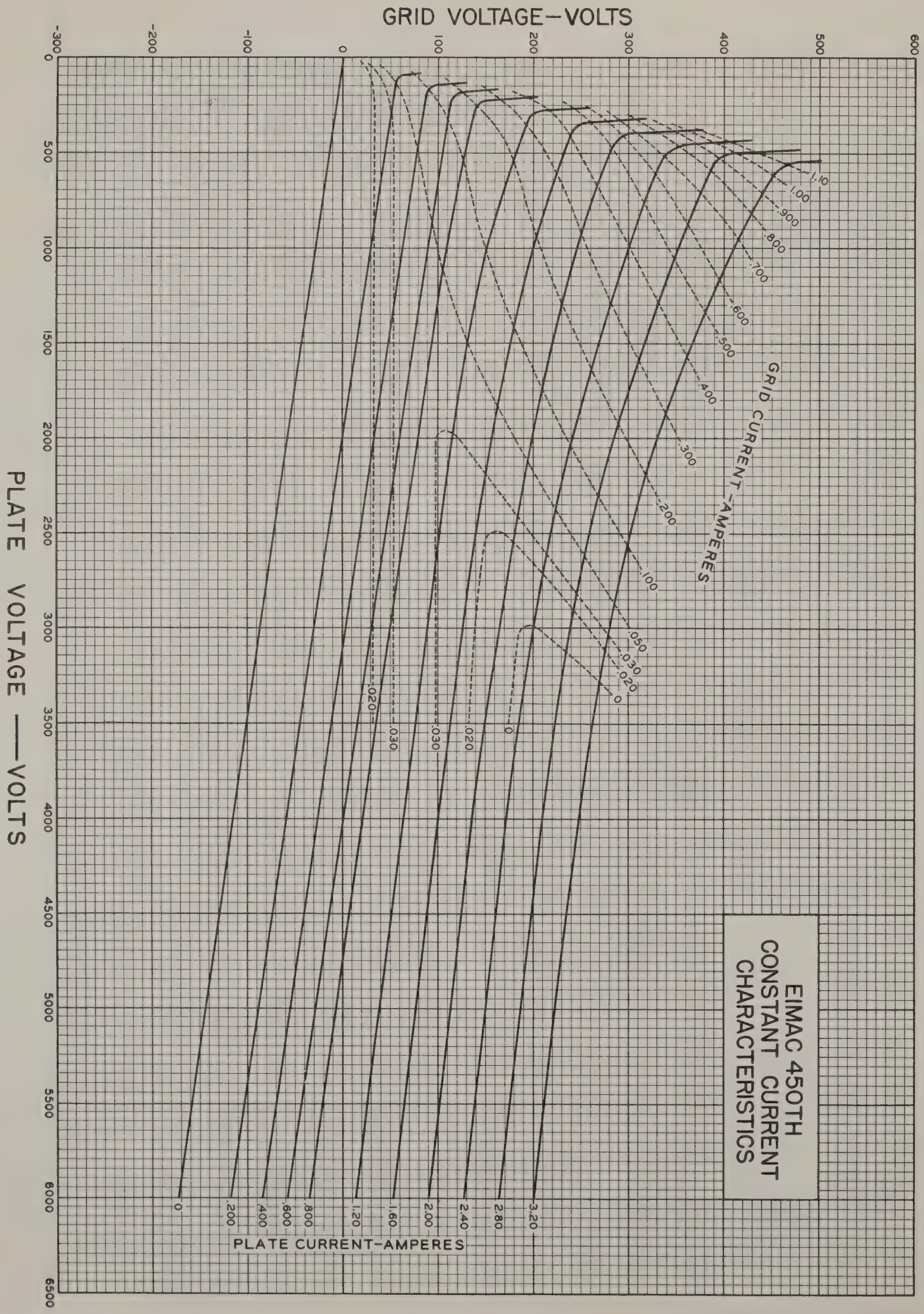
The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 3000, 4000, and 5000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 3000, 4000, and 5000 volts respectively.







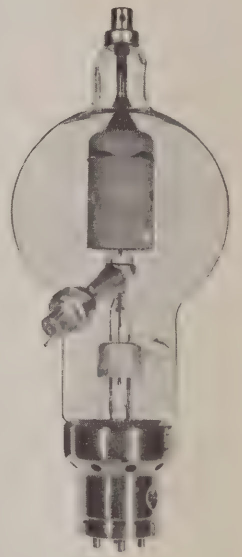

GRID VOLTAGE—VOLTS
-300
-200
-100
0
100
200
300
400
500
600
PLATE VOLTAGE —VOLTS
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
GRID CURRENT—AMPERES
1.10
1.00
.900
.800
.700
.600
.500
.400
.300
.200
.100
.050
.030
.020
0
.020
.030
.030
.020
0
PLATE CURRENT—AMPERES
0
.200
.400
.600
.800
1.20
1.60
2.00
2.40
2.80
3.20
EIMAC 450TH
CONSTANT CURRENT
CHARACTERISTICS

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

450TL

MEDIUM-MU TRIODE

MODULATOR
OSCILLATOR
AMPLIFIER



The Eimac 450TL is a medium-mu power triode having a maximum plate dissipation rating of 450 watts, and is intended for use as an amplifier, oscillator and modulator. It can be used at its maximum ratings at frequencies as high as 40-Mc.

Cooling of the 450TL is accomplished by radiation from the plate, which operates at a visible red color at maximum dissipation, and by means of air circulation around the envelope.

GENERAL CHARACTERISTICS

▶ ELECTRICAL

Filament: Thoriated tungsten

Voltage	7.5 volts
Current	12.0 amperes

Note: Dual connections for each filament lead are provided within the base of the tube (see basing diagram). Corresponding socket terminals must be connected in parallel to provide proper distribution of filament and R-F charging currents.

Amplification Factor (Average)	18
Direct Interelectrode Capacitances (Average)	
Grid-Plate	4.5 µµf
Grid-Filament	6.8 µµf
Plate-Filament	0.8 µµf
Transconductance ($i_b = 500$ma, $E_b = 4000$v, $e_c = -75$v.)	5000 µmhos
Frequency for Maximum Ratings	40-Mc.

▶ MECHANICAL

Base	Special 4 pin, No. 5002B
Basing	RMA type 4AQ
Mounting	Vertical, base down or up
Cooling	Radiation and air circulation

Note: Adequate ventilation or air cooling must be provided so that the seals and envelope do not exceed 200°C under operating conditions.

Socket - - - Johnson Type No. 211 or National Type No. XM50 or equivalent.

Recommended Heat Dissipating Connectors:

Plate	Eimac HR-8
Grid	Eimac HR-8

Note: The grid terminal of the 450TL is now .560" in diameter. To accommodate existing equipment designed for the older style 450TL having .098" diameter grid terminals, an adapter pin is provided with the newer tubes. This adapter pin is threaded so that it may be removed from the grid terminal of the tube. The small grid terminal, if used, requires an HR-4 heat dissipating connector. (See outline drawing.)

Maximum Overall Dimensions:

Length	12.625 inches
Diameter	5.125 inches
Net weight	1.3 pounds
Shipping weight (Average)	5.6 pounds

▶ AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class AB$_2$ (Sinusoidal wave, two tubes unless otherwise specified)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	6000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT PER TUBE	600 MAX. MA.
PLATE DISSIPATION, PER TUBE	450 MAX. WATTS

TYPICAL OPERATION—2 TUBES

D-C Plate Voltage	3000	4000	5000	Volts
D-C Grid Voltage (approx.)*	—110	—175	—240	Volts
Zero-Signal D-C Plate Current	200	150	120	Ma.
Max-Signal D-C Plate Current	770	675	620	Ma.
Effective Load, Plate-to-Plate	7700	12,800	18,500	Ohms
Peak A-F Grid Input Voltage (per tube)	325	365	430	Volts
Max-Signal Peak Driving Power	40	33	56	Watts
Max-Signal Nominal Driving Power (approx.)	20	17	28	Watts
Max-Signal Plate Power Output	1400	1800	2200	Watts

*Adjust to give stated zero-signal plate current.

▶ RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony (Key-down conditions, per tube).

MAXIMUM RATINGS

D-C PLATE VOLTAGE	6000 MAX. VOLTS
D-C PLATE CURRENT	600 MAX. MA.
PLATE DISSIPATION	450 MAX. WATTS
GRID DISSIPATION	65 MAX. WATTS

TYPICAL OPERATON, PER TUBE*

D-C Plate Voltage	3000	4000	5000	Volts
D-C Grid Voltage	—275	—400	—500	Volts
D-C Plate Current	500	450	450	Ma.
D-C Grid Current	65	53	54	Ma.
Peak R-F Grid Input Voltage	640	740	870	Volts
Driving Power (approx.)	38	35	42	Watts
Grid Dissipation	20	13	15	Watts
Plate Power Input	1500	1800	2250	Watts
Plate Dissipation	450	450	450	Watts
Plate Power Output	1050	1350	1800	Watts

*The figures show actual measured tube performance and do not allow for circuit losses.

▶ PLATE MODULATED RADIO FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	4500 MAX. VOLTS
D-C PLATE CURRENT	500 MAX. MA.
PLATE DISSIPATION	300 MAX. WATTS
GRID DISSIPATION	65 MAX. WATTS

TYPICAL OPERATION, PER TUBE*

D-C Plate Voltage	3000	4000	4500	Volts
D-C Plate Current	380	340	345	Ma.
Total Bias Voltage	—400	—500	—550	Volts
Fixed Bias Voltage	—200	—250	—275	Volts
Grid Resistor	5000	7000	7500	Ohms
D-C Grid Current	40	36	36	Ma.
Peak R-F Grid Input Voltage	700	790	850	Volts
Driving Power	28	29	31	Watts
Grid Dissipation	12	11	11	Watts
Plate Power Input	1150	1360	1550	Watts
Plate Dissipation	300	300	300	Watts
Plate Power Output	850	1060	1250	Watts

*The figures are for one tube operating at maximum plate dissipation as a plate modulated Class-C amplifier. The output figures do not allow for circuit losses.

▶ Indicates change from sheet dated 9-1-44.

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APPLICATION

MECHANICAL

Mounting—The 450TL must be mounted vertically, base up or base down. Flexible connecting straps should be provided from the grid and plate terminals to the external grid and plate circuits. The tube must be protected from severe vibration and shock.

Cooling—Provision should be made for ample circulation of air around the 450TL. In the event that the design of the equipment restricts natural circulation, the use of a small fan or centrifugal blower to provide additional cooling for the tube will aid in obtaining maximum tube life. Special heat-dissipating connectors (Eimac HR-8) are available for use on the plate and grid terminals. These connectors help to prolong tube life by reducing the temperature of the seals.

ELECTRICAL

Filament Voltage—For maximum tube life the filament voltage, as measured directly at the filament pins, should be the rated value of 7.5 volts. Unavoidable variations in filament voltage must be kept within the range from 7.03 to 7.88 volts. All four socket terminals should be used, putting two in parallel for each filament connection.

Bias Voltage—Although there is no maximum limit on the bias voltage which may be used on the 450TL, there is little advantage in using bias voltages in excess of those given under "Typical Operation," except in certain very specialized applications. Where bias is obtained by a grid leak, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation.

Grid Dissipation—The power dissipated by the grid of the 450TL must not exceed 65 watts. Grid dissipation may be calculated from the following expression:

$$P_g = e_{cmp} I_c$$

where P_g = Grid dissipation
e_{cmp} = Peak positive grid voltage, and
I_c = D-c grid current.

e_{cmp} may be measured by means of a suitable peak voltmeter connected between filament and grid.[1] In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any conditions of loading.

Plate Voltage—Except in very special applications, the plate supply voltage for the 450TL should not exceed 6000 volts. In most cases there is little advantage in using plate-supply voltages higher than those given under "Typical Operation" for the power output desired.

Plate Dissipation—Under normal operating conditions, the power dissipated by the plate of the 450TL should not be allowed to exceed 450 watts. At this dissipation the brightness temperature of the plate will appear a red-orange in color. The value of this color is somewhat affected by light from the filament as well as from external sources. Plate dissipation in excess of the maximum rating is permissible for short periods of time, such as during tuning procedures.

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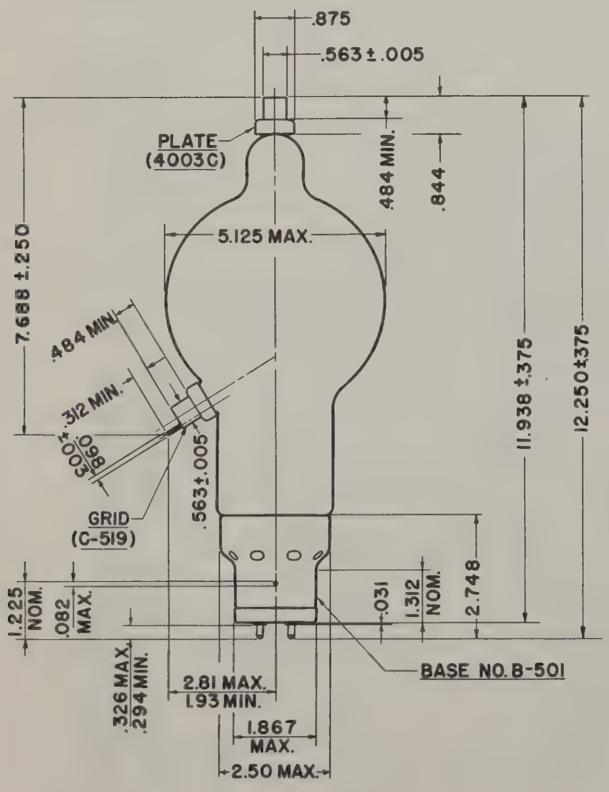
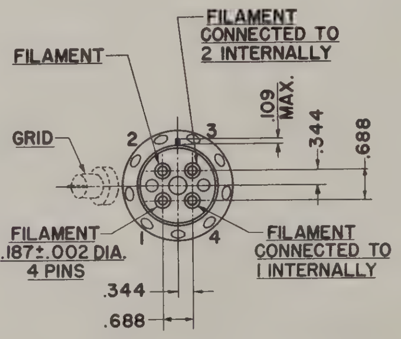
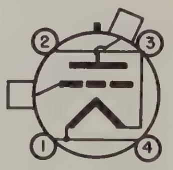
[1] For suitable peak v.t.v.m. circuits see, for instance, "Vacuum Tube Ratings," **Eimac News**, January, 1945. This article is available in reprint form on request.




FILAMENT
FILAMENT CONNECTED TO 2 INTERNALLY
GRID
2
3
1
4
.109 MAX.
.344
.688
FILAMENT .187±.002 DIA. 4 PINS
FILAMENT CONNECTED TO 1 INTERNALLY
.344
.688

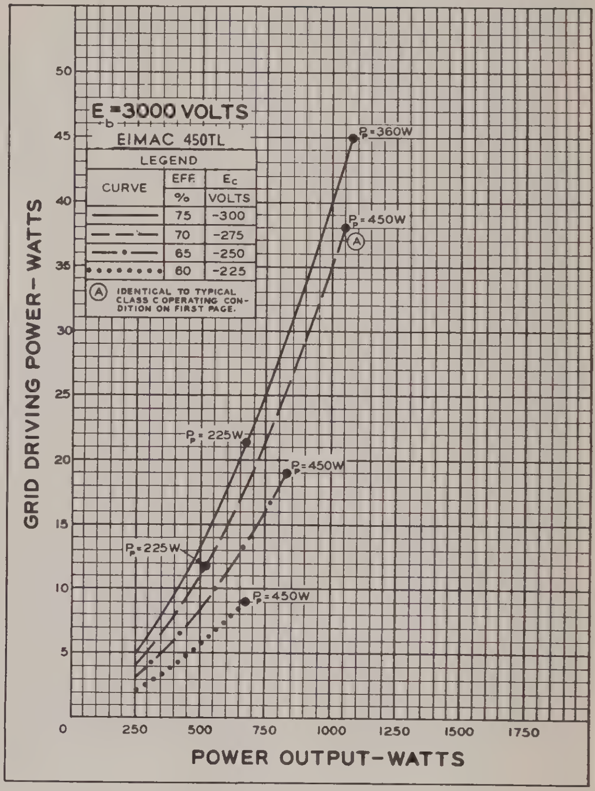


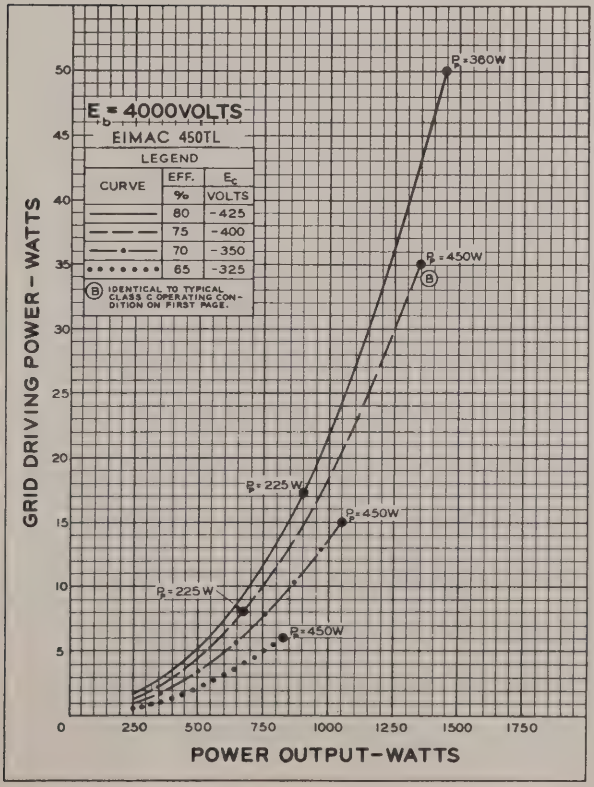
NOTE:—The grid terminal on the new 450TH and TL type tube is now .563" in diameter. To accommodate existing equipment which uses the 450TH or TL tubes with the old style .098" grid terminal, an adaptor pin is provided. This adaptor pin, if not needed, may be removed by unscrewing.

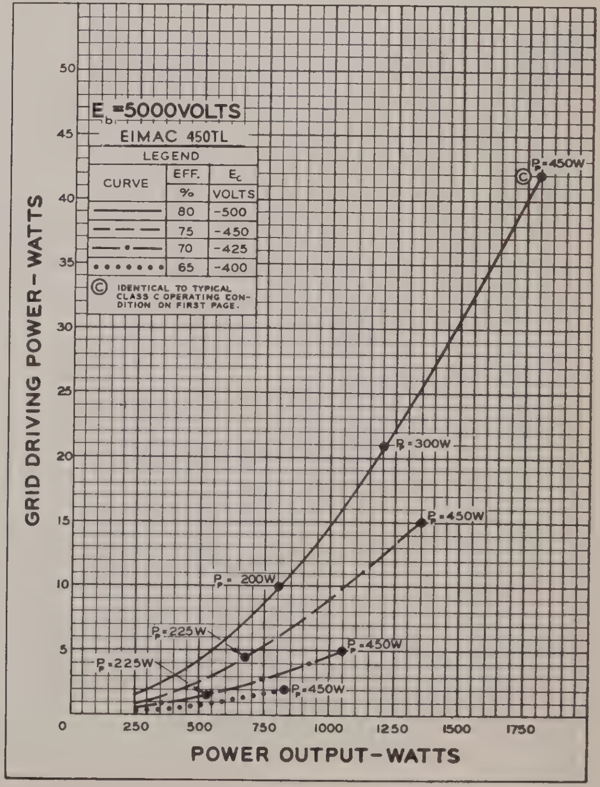
DRIVING POWER vs. POWER OUTPUT

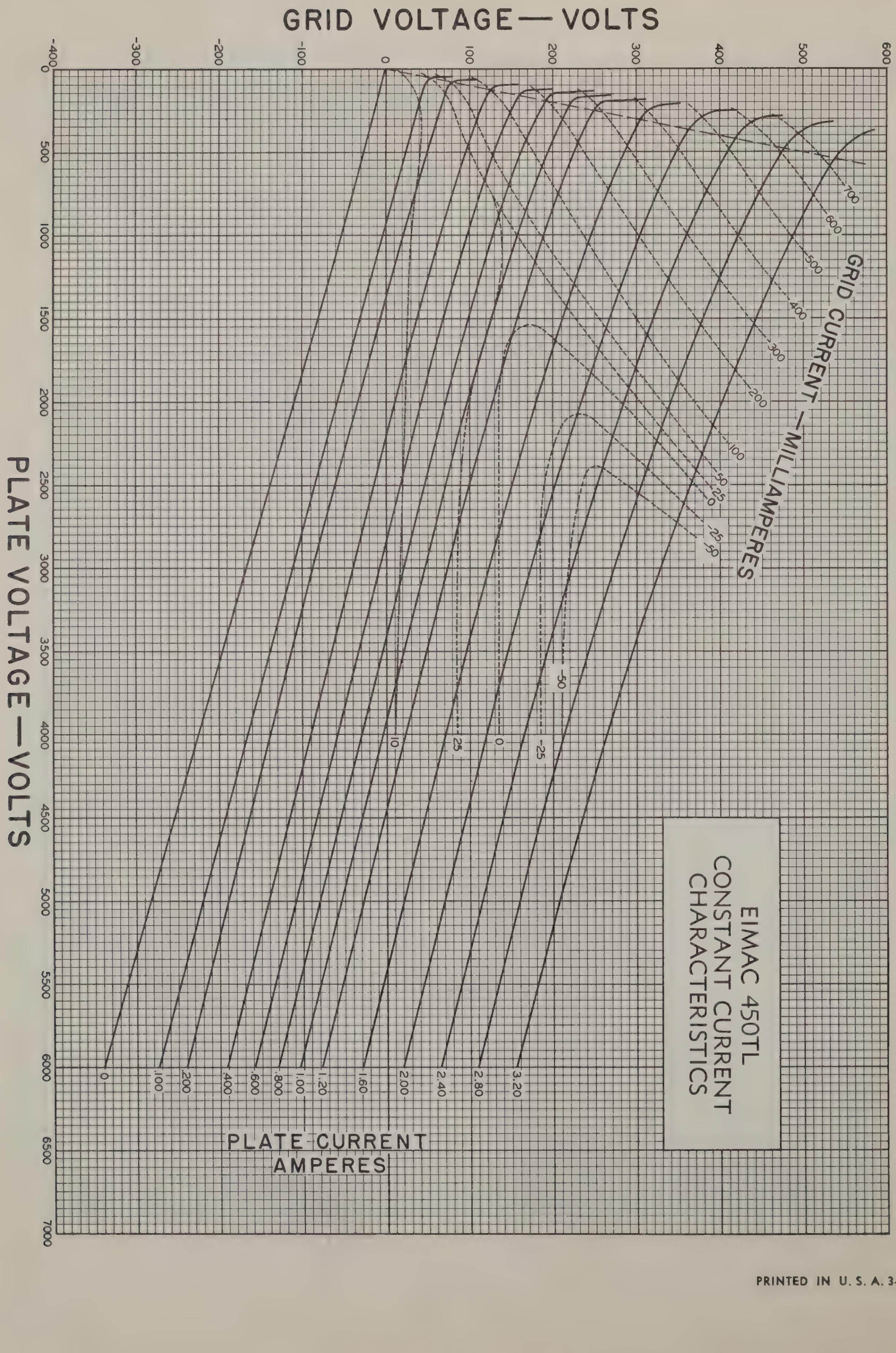
The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 3000, 4000, and 5000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 3000, 4000, and 5000 volts respectively.








GRID VOLTAGE — VOLTS
-400
-300
-200
-100
0
100
200
300
400
500
600
PLATE VOLTAGE — VOLTS
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
7000
GRID CURRENT — MILLIAMPERES
700
600
500
400
300
200
100
50
25
0
-25
-50
10
25
0
-25
-50
0
.100
.200
.400
.600
.800
1.00
1.20
1.60
2.00
2.40
2.80
3.20
PLATE CURRENT AMPERES
EIMAC 450TL
CONSTANT CURRENT
CHARACTERISTICS

TENTATIVE DATA

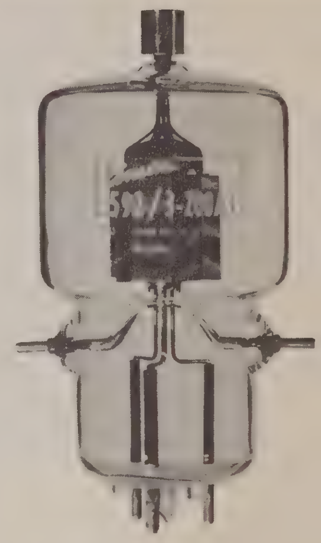
EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

592/3-200A3

MEDIUM-MU TRIODE

•

MODULATOR OSCILLATOR AMPLIFIER



The Eimac 592/3-200A3 is a medium-mu power triode having a maximum plate dissipation rating of 200 watts, and it is intended for use as a power amplifier, oscillator, or modulator. It can be used at its maximum ratings at frequencies as high as 150 Mc.

Cooling of the 592/3-200A3 is accomplished by radiation from the plate, which operates at a visible red color at maximum plate dissipation, and by means of forced-air circulation around the envelope.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated tungsten	
Voltage	10.0 volts
Current	5.0 amperes
Amplification Factor (Average)	25
Direct Interelectrode Capacitances (Average)	
Grid-Plate	3.3 μμf
Grid-Filament	3.6 μμf
Plate-Filament	0.29 μμf
Transconductance (i_b=200 ma., E_b=3000 v.)	3600 μmhos
Frequency for Maximum Ratings	150 Mc.

MECHANICAL

Mounting	Vertical
Maximum Overall Dimensions:	
Length	6.0 inches
Diameter	3-13/32 inches
Net Weight (approx.)	6 ounces
Shipping Weight (approx.)	1½ pounds

COOLING

An air-flow of 15 cubic feet per minute should be directed at the bulb from a 2-inch diameter nozzle located about 3 inches from the center line of the tube. The center line of the nozzle should be located about 2 inches down from the top of the plate terminal. The incoming air temperature should not exceed 50° C. Other methods of cooling may be used provided maximum bulb and seal temperatures are not exceeded. An 8-inch fan located about 10 inches from the tube is one alternate method.

Maximum bulb temperature - - - - 225° C

Maximum seal temperature - - - - 175° C

AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS B

MAXIMUM RATINGS, PER TUBE

D-C PLATE VOLTAGE	3500 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT	250 MAX. MA.
PLATE DISSIPATION	200 MAX. WATTS
GRID DISSIPATION	25 MAX. WATTS

TYPICAL OPERATION
Sinusoidal wave, two tubes unless otherwise specified.

D-C Plate Voltage	2000	2500	3000	Volts
D-C Grid Voltage (approx.)*	—50	—70	—90	Volts
Zero-Signal D-C Plate Current	120	100	80	Ma.
Max-Signal D-C Plate Current	500	450	400	Ma.
Effective Load, Plate-to-Plate	8500	12,600	18,000	Ohms
Peak A-F Grid Input Voltage (per tube)	260	270	270	Volts
Max-Signal Peak Driving Power	50	52	40	Watts
Max-Signal Nominal Driving Power (approx.)	25	26	20	Watts
Max-Signal Plate Power Output	600	725	820	Watts

*Adjust to give stated zero-signal plate current.

PLATE MODULATED RADIO FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	2600 MAX. VOLTS
D-C PLATE CURRENT	200 MAX. MA.
PLATE DISSIPATION	130 MAX. WATTS
GRID DISSIPATION	25 MAX. WATTS

TYPICAL OPERATION

D-C Plate Voltage	2000	2500	Volts
D-C Plate Current	200	200	Ma.
D-C Grid Voltage	—250	—300	Volts
D-C Grid Current	35	35	Ma.
Peak R-F Grid Input Voltage	480	535	Volts
Driving Power	17	19	Watts
Grid Dissipation	8	9	Watts
Plate Power Input	400	500	Watts
Plate Dissipation	115	125	Watts
Plate Power Output	285	375	Watts

The output figures do not allow for circuit losses.

RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony
(Key-down conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	3500 MAX. VOLTS
D-C PLATE CURRENT	250 MAX. MA.
PLATE DISSIPATION	200 MAX. WATTS
GRID DISSIPATION	25 MAX. WATTS

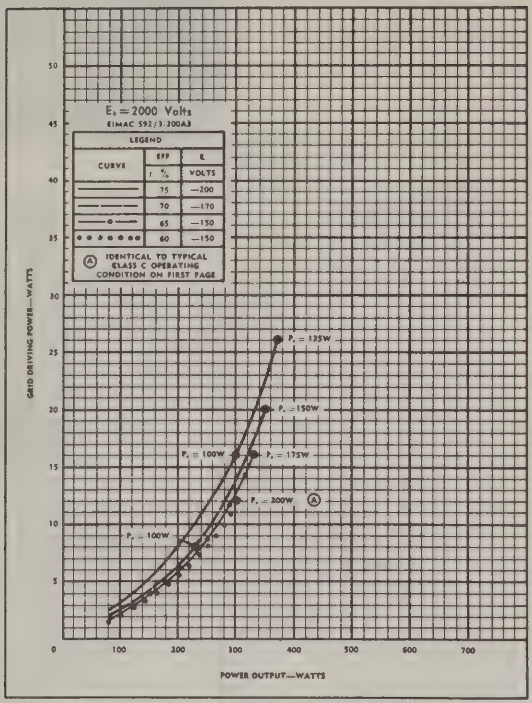
TYPICAL OPERATION

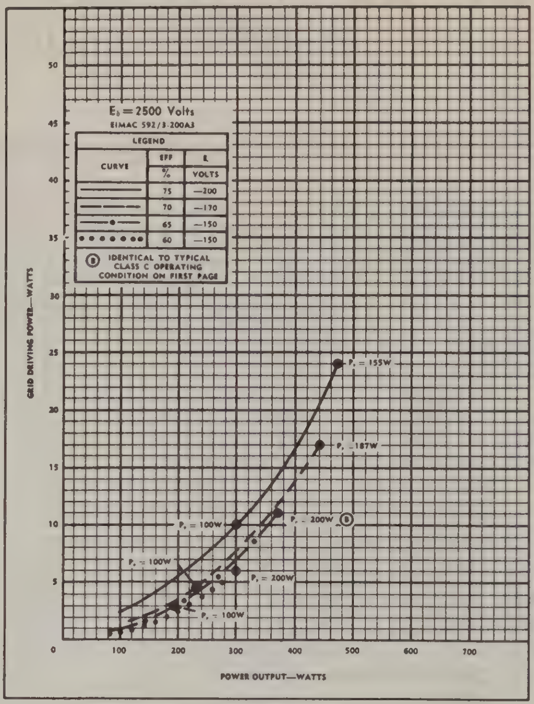
D-C Plate Voltage	2000	2500	3000	3500	Volts
D-C Plate Current	250	228	222	228	Ma.
D-C Grid Voltage	—150	—180	—220	—270	Volts
D-C Grid Current	32	28	25	30	Ma.
Peak R-F Grid Input Voltage	380	400	440	505	Volts
Driving Power	12	11	11	15	Watts
Grid Dissipation	7	6	5.5	7	Watts
Plate Power Input	500	570	666	800	Watts
Plate Dissipation	200	200	200	200	Watts
Plate Power Output	300	370	466	600	Watts

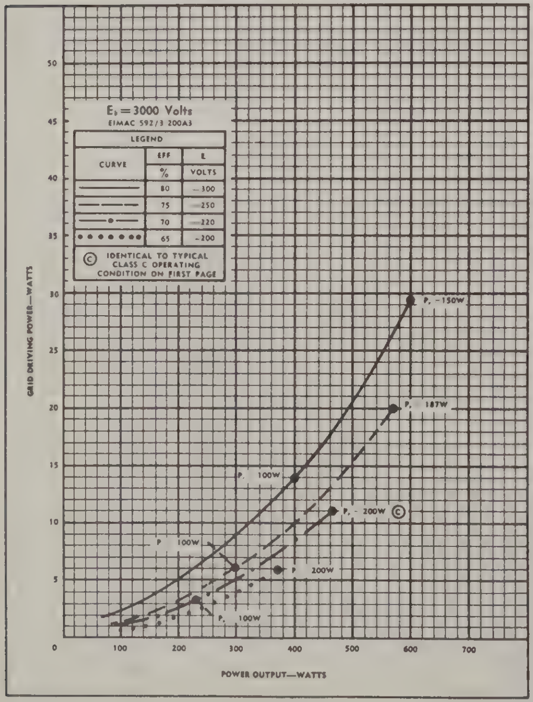
The output figures do not allow for circuit losses.

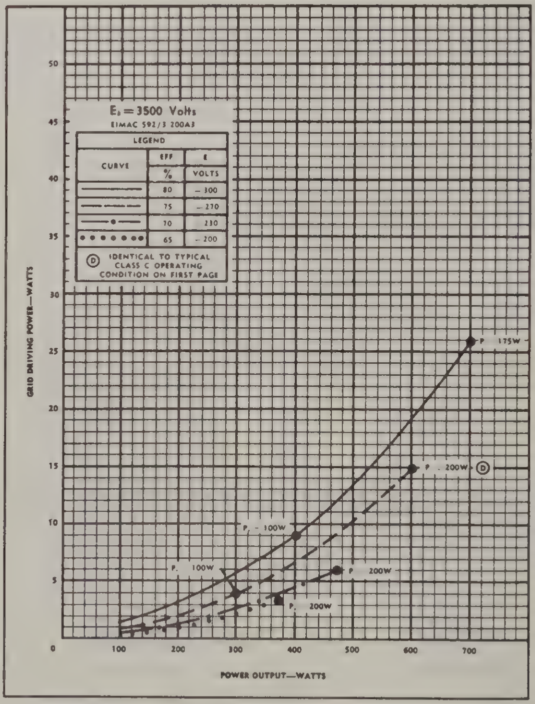
(Effective 2-15-50) Copyright 1950 by Eitel-McCullough, Inc.

TENTATIVE DATA





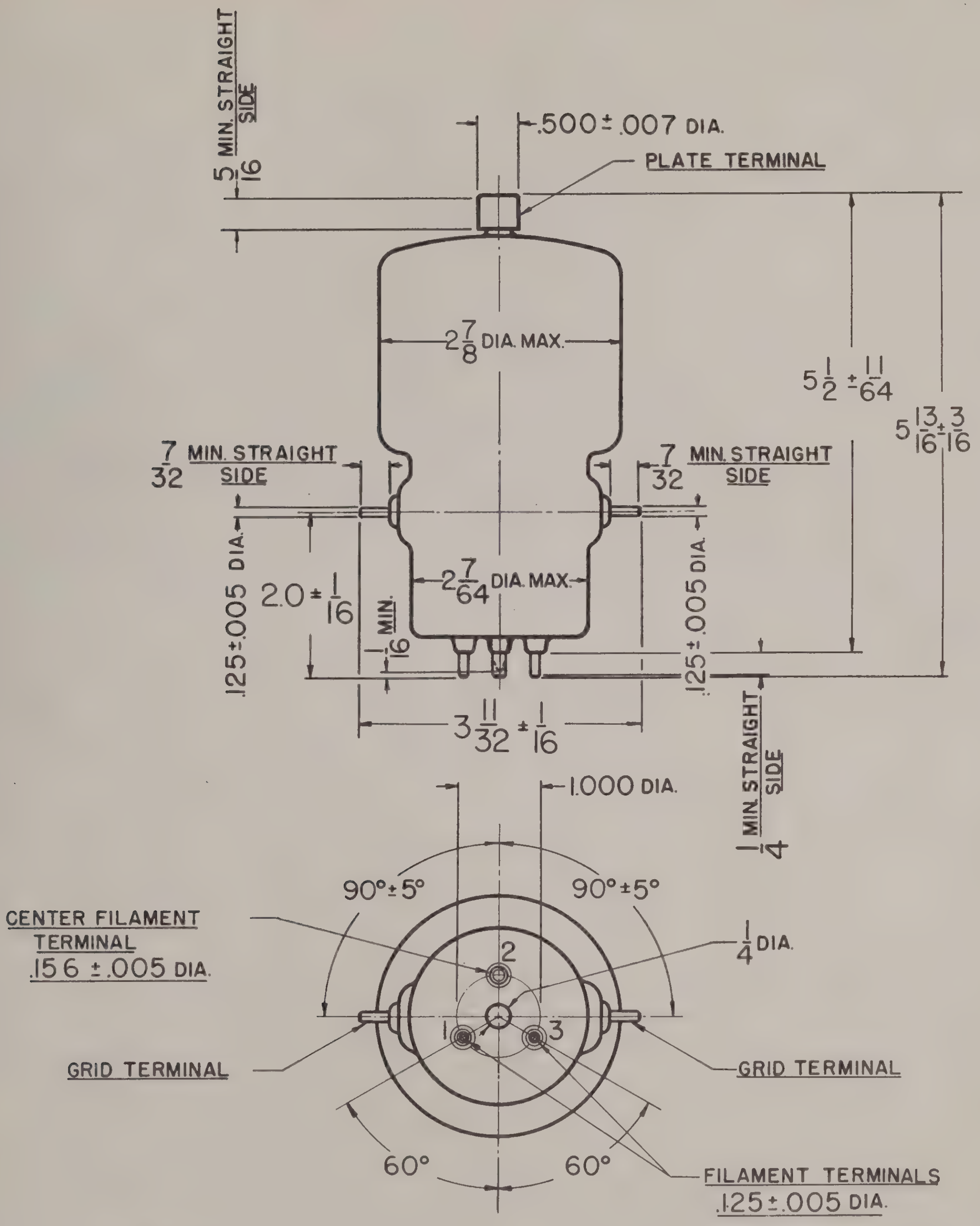




DRIVING POWER vs. POWER OUTPUT

The four charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 2000, 2500, 3000 and 3500 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

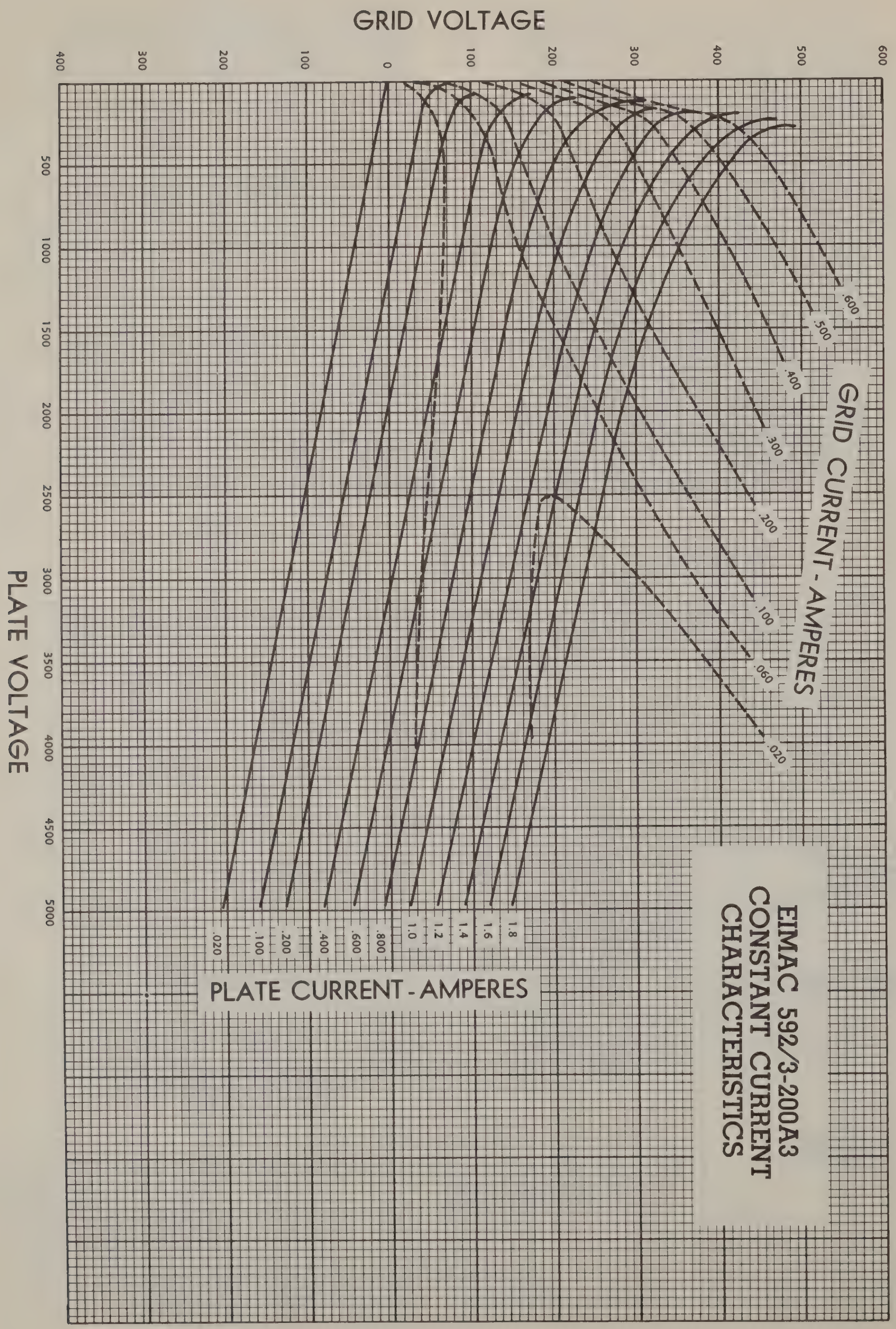
Points A, B, C, and D are identical to the typical Class C operating conditions shown on the first page under 2000, 2500, 3000 and 3500 volts respectively.



DIMENSIONS IN INCHES

BOTTOM VIEW

NOTE: CENTER FILAMENT TERMINAL, FILAMENT TERMINALS, AND TUBULATION ARE SO ALIGNED THAT THEY CAN BE FREELY INSERTED INTO A GAGE 1/4" THICK WITH HOLE DIA. .186", .155", & .350" RESPECTIVELY, LOCATED ON THE TRUE CENTERS BY THE GIVEN DIMENSIONS.



EIMAC 592/3-200A3 CONSTANT CURRENT CHARACTERISTICS

EIMAC
Division of Varian
SAN CARLOS
CALIFORNIA

3-500Z

HIGH-MU POWER TRIODE

The EIMAC 3-500Z is a compact power triode intended to be used as a zero-bias Class-AB$_2$ amplifier in audio or radio-frequency applications. Operation with zero grid bias simplifies associated circuitry by eliminating the bias supply. In addition, grounded-grid operation is attractive since a power gain as high as twenty times can be obtained with the 3-500Z in a cathode-driven circuit.

GENERAL CHARACTERISTICS [1]

ELECTRICAL

Filament: Thoriated Tungsten	
Voltage	5.0 ± 0.25 V
Current, at 5.0 volts	14.5 A
Amplification Factor (Average)	160
Direct Interelectrode Capacitances (grounded filament)[2]	
Input	8.3 pF
Output	0.07 pF
Feedback	4.7 pF
Direct Interelectrode Capacitances (grounded grid)[2]	
Input	8.3 pF
Output	4.7 pF
Feedback	0.07 pF
Frequency of Maximum Rating:	
CW	110 MHz

---

[1] Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.

[2] In Shielded Fixture.

MECHANICAL

Maximum Overall Dimensions:	
Length	5.875 in; 149.23 mm
Diameter	3.438 in; 87.33 mm
Net Weight	7.0 oz; 198.5 gm
Operating Position	Vertical, base down or up
Maximum Operating Temperature:	
Plate Seal	225°C
Base Seals	200°C
Cooling	Radiation and forced air
Base	5 Pin Special
Recommended Socket	EIMAC SK-410
Recommended Chimney	EIMAC SK-406
Recommended Heat-Dissipating Connector:	
Plate	HR-6

(Revised 7-1-70) © 1968, 1970 by Varian Printed in U.S.A.

RADIO FREQUENCY LINEAR AMPLIFIER CATHODE DRIVEN

Class AB_2

MAXIMUM RATINGS:

DC PLATE VOLTAGE	4000	VOLTS
DC PLATE CURRENT	0.4	AMPERE
PLATE DISSIPATION	500	WATTS
GRID DISSIPATION	20	WATTS

TYPICAL OPERATION (Frequencies to 110 MHz)
Class AB2, Peak Envelope or Modulation Crest Conditions

Plate Voltage	1500	2000	2500	3000	3500	Vdc
Cathode Voltage[1]	0	0	0	+10	+15	Vdc
Zero Signal Plate Current[2]	65	95	130	62	53	mAdc
Single-Tone Plate Current, CW[3/4]	400	400	400	400	400	mAdc
Two-Tone Plate Current	260	270	280	268	262	mAdc
Single-Tone Grid Current[2]	130	130	120	108	108	mAdc
Two-Tone Grid Current[2]	80	80	70	60	58	mAdc
Single-Tone Power Input	600	800	1000	1200	1400	W
Useful Output Power, CW or PEP	330	500	600	740	890	W
Resonant Load Impedance	1600	2750	3450	4200	5000	Ω
Intermodulation Distortion Products[5]						
3rd Order	-46	-38	-33	-40	-40	db
5th Order	---	---	---	-46	-45	db

1. Zener diode positive bias used at plate potentials of 3 kV and above.
2. Approximate value.
3. Currents listed correspond to SSB, or "two-tone" average current at peak of signal envelope.
4. Single-tone current for 3500 Vdc operation may reach this value during short periods of circuit adjustment only.
5. Intermodulation distortion products are referenced against one tone of a two equal tone signal.

RADIO FREQUENCY POWER AMPLIFIER OR OSCILLATOR GRID DRIVEN, CATHODE DRIVEN

Class AB_2 and C Telegraphy or FM Telephony
(Key-Down Conditions)

MAXIMUM RATINGS:

DC PLATE VOLTAGE	4000	VOLTS
DC PLATE CURRENT	0.35	AMPERE
PLATE DISSIPATION	500	WATTS
GRID DISSIPATION	20	WATTS

TYPICAL OPERATION (Frequencies to 110 MHz)

	Grid Driven		Cathode Driven		
Plate Voltage	3000	3500	3000	3500	Vdc
Grid Voltage	0	-75	0	-75	Vdc
Plate Current	350	300	333	350	mAdc
Grid Current	115	115	108	118	mAdc
Peak rf (Cathode) (Grid) Voltage	---	187	215	215	v
Measured Driving Power	30	22	87	98	W
Plate Input Power	1050	1050	1000	1225	W
Plate Dissipation	330	200	250	305	W
Useful Output Power	720	850	750	920	W
Resonant Load Impedance	4200	5700	4800	5500	Ω

PLATE MODULATED RADIO FREQUENCY POWER AMPLIFIER-GRID DRIVEN

Class C Telephony (Carrier Conditions)

MAXIMUM RATINGS:

DC PLATE VOLTAGE	3000	VOLTS
DC PLATE CURRENT	0.275	AMPERE
PLATE DISSIPATION[1]	330	WATTS
GRID DISSIPATION[2]	20	WATTS

1. Corresponds to 500 watts at 100% sine-wave modulation.
2. Average, with or without modulation.

TYPICAL OPERATION (Frequencies to 30 MHz)

Plate Voltage	3000	Vdc
Grid Voltage	-100	Vdc
Plate Current	275	mAdc
Grid Current[1]	120	mAdc
Peak rf Grid Voltage[1]	200	v
Calculated Driving Power	25	W
Plate Input Power	825	W
Plate Dissipation	185	W
Plate Output Power	640	W

1. Approximate value.

AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR

Class AB$_2$, Grid Driven (Sinusoidal Wave)

MAXIMUM RATINGS (Per Tube):

DC PLATE VOLTAGE[1]	4000	VOLTS
DC PLATE CURRENT	0.4	AMPERE
PLATE DISSIPATION	500	WATTS
GRID DISSIPATION	20	WATTS

1. See zero-bias operation in Application Section.
2. Approximate value.
3. Per Tube.
4. Nominal drive power is one-half peak power.

TYPICAL OPERATION (Two Tubes)

Plate Voltage	3000	Vdc
Grid Voltage	0	Vdc
Zero-Signal Plate Current[2]	300	mAdc
Max. Signal Plate Current	770	mAdc
Max. Signal Grid Current[2]	244	mAdc
Peak af Grid Voltage[3]	100	v
Peak Driving Power[4]	25	w
Plate Input Power	2310	W
Max. Signal Plate Dissipation	890	W
Plate Output Power	1420	W
Load Resistance (plate to plate)	8600	Ω

NOTE: TYPICAL OPERATION data are obtained by calculation from published characteristic curves or actual measurment. Adjustment of the rf grid voltage to obtain the specified plate current at the specified bias and plate voltages is assumed. If this procedure is followed, there will be little variation in output power when the tube is changed, even though there may be some variation in grid current. The grid current which results when the desired plate current is obtained is incidental and varies from tube to tube. These current variations cause no difficulty so long as the circuit maintains the correct voltage in the presence of the variations in current. If grid bias is obtained principally by means of a grid resistor, the resistor must be adjustable to obtain the required bias voltage when the correct rf grid voltage is applied.

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.	
Filament: Current at 5.0 volts	13.5	14.7	A
Interelectrode Capacitances[1] (grounded filament connection)			
Input	6.5	10.0	pF
Output	---	0.18	pF
Feedback	4.2	5.2	pF
Interelectrode Capacitances[1] (grounded grid connection)			
Input	6.5	10.0	pF
Output	4.2	5.2	pF
Feedback	---	0.18	pF
Zero Signal Plate Current:			
(E_c = 0Vdc, E_b = 2500 Vdc)	90	180	mAdc

APPLICATION

MECHANICAL

MOUNTING - The 3-500Z must be operated vertically, base up or down. A flexible connecting strap should be provided between the heat dissipating plate connector and the external plate circuit. The tube must be protected from severe vibration and shock.

SOCKET - The EIMAC SK-410 air system socket and SK-406 chimney are recommended for use with the 3-500Z. When a socket other than the SK-410 is used, provisions must be made for equivalent cooling of the base, the envelope, and the plate lead.

If a socket other than the EIMAC SK-410 is employed, the user must assure himself that lateral pressure is not applied to the tube pins and base seal. Otherwise damage to the tube may result.

CAUTION-GLASS IMPLOSION - The EIMAC 3-500Z is pumped to a very high vacuum, which is contained by a glass envelope. When handling a glass tube, remember that glass is a relatively fragile material, and accidental breakage can result at any time. Breakage will result in flying glass fragments, so safety glasses, heavy clothing, and leather gloves are recommended for protection.

COOLING - Forced-air cooling is required to maintain the base seals at a temperature below 200°C, and the plate seal at a temperature below 225°C. Air-flow requirements to maintain the above maximum temperatures are tabulated below. (For operation below 30 MHz)

Base-to-Anode Air Flow		
Anode Dissipation (Watts)	Air Flow (CFM)	Pressure Drop (inches-WC)
300	6.6	.023
400	10.3	.052
500	13.0	.082

The anode of the 3-500Z operates at a visibly red color at its maximum rated dissipation of 500 watts.

In all cases, air flow rates in excess of the minimum requirements will prolong tube life. NOTE: Two 3-500Z tubes in a single amplifier, chassis mounted, may be adequately cooled by use of a fan so mounted as to pressurize the space below the sockets. Fans suitable for use at or near sea level are Pamotor Model 2000, or Model 6500. The Rotron "Spartan" fan (3200 rpm) is also suitable, as is a #3, 3-inch squirrel cage blower (3100 rpm).

In all cases, the only criteria of proper cooling is the temperature of the tube seals. Tube temperatures may be measured with the aid of temperature sensitive paint, spray, or crayon. Suitable products are manufactured by the Tempil Division, Big Three Industrial Gas & Equipment Co., Hamilton Blvd., So. Plainfield, N.J. 07080.

ZERO-BIAS OPERATION - Operation at zero-bias is not recommended with plate voltages over 3000 since plate dissipation may be exceeded. A zener diode placing positive bias on the cathode or other constant voltage source may be used to reduce zero signal plate current at plate potentials over 2500 volts.

CLASS-C OPERATION - Although specifically designed for linear amplifier service, the 3-500Z may be operated as a class-C power amplifier or oscillator or as a plate-modulated radio-frequency power amplifier. The zero-bias characteristic of the 3-500Z can be used to advantage in class-C amplifiers operating at plate voltages of 3000 volts or below by employing only grid-resistor bias. If driving power fails, plate dissipation is then kept to a low value because the tube will be operating at the normal static zero-bias conditions.

ELECTRICAL

FILAMENT OPERATION - The rated filament voltage for the 3-500Z is 5.0 volts. Filament voltage, as measured at the socket, must be maintained within the range of 4.75 to 5.25 volts to obtain maximum tube life.

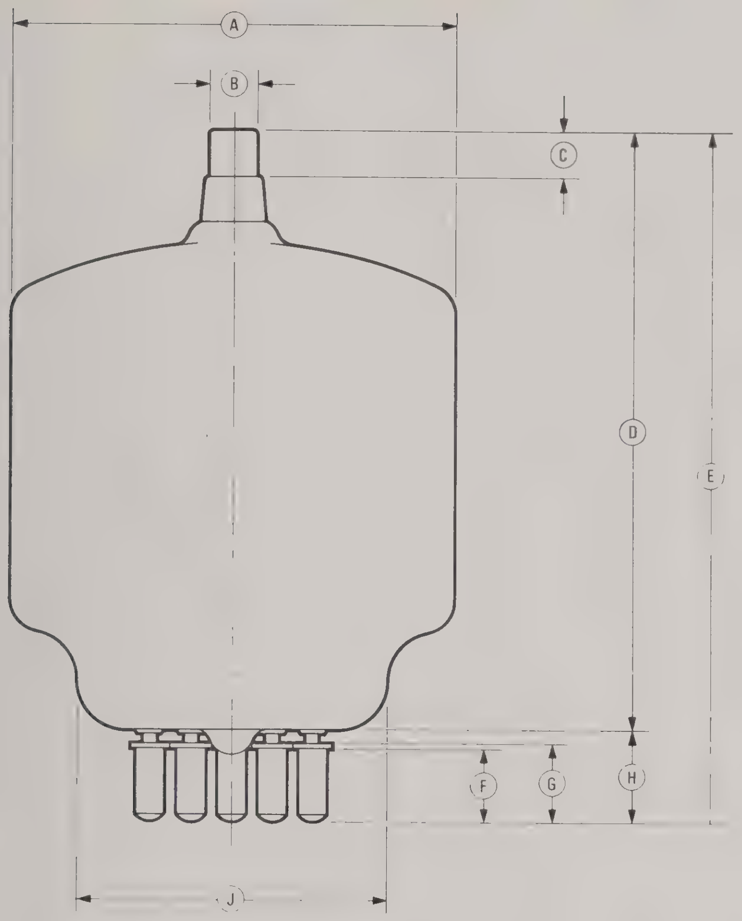
CAUTION-HIGH VOLTAGE - Operating voltage for the 3-500Z can be deadly, so the equipment must be designed properly and operating precautions must be followed. Design equipment so that no one can come in contact with high voltages. All equipment must include safety enclosures for high voltage circuits and terminals, with interlock switches to open the primary circuits of the power supply and to discharge high voltage capacitors whenever access doors are opened. Interlock switches must not be bypassed or "cheated" to allow operation with access doors open. Always remember that HIGH VOLTAGE CAN KILL.

INTERMODULATION DISTORTION - Typical operating conditions with distortion values included are the result of data taken during actual operation at 2 megahertz. Intermodulation values listed are those measured at the full peak envelope power noted.

INPUT CIRCUIT - When the 3-500Z is operated as a grounded-grid rf amplifier, the use of a resonant tank in the cathode circuit is recommended in order to obtain greatest linearity and power output. For best results with a single-ended amplifier it is suggested that the cathode tank circuit operate at a Q of two or more.

SPECIAL APPLICATIONS - If it is desired to operate this tube under conditions widely different from those given here, write to Power Crid Tube Division, EIMAC Division of Varian, 301 Industrial Way, San Carlos, California 94070 for information and recommendation.

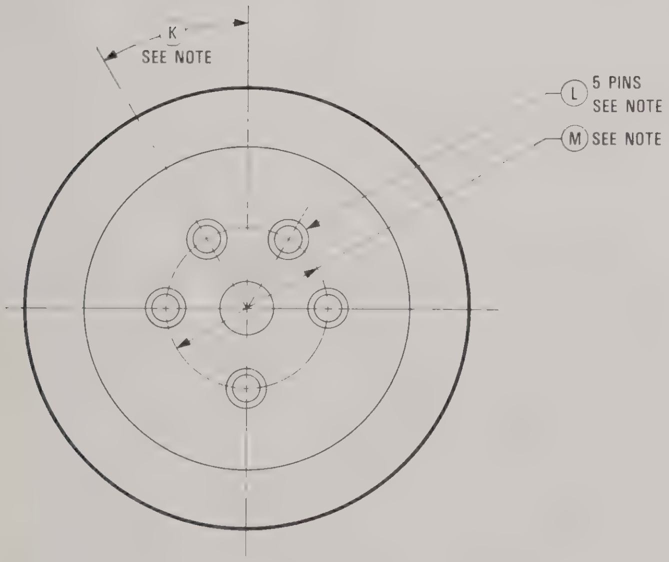
3-500Z OUTLINE DRAWING AND PIN CONNECTIONS

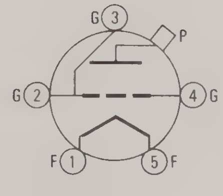


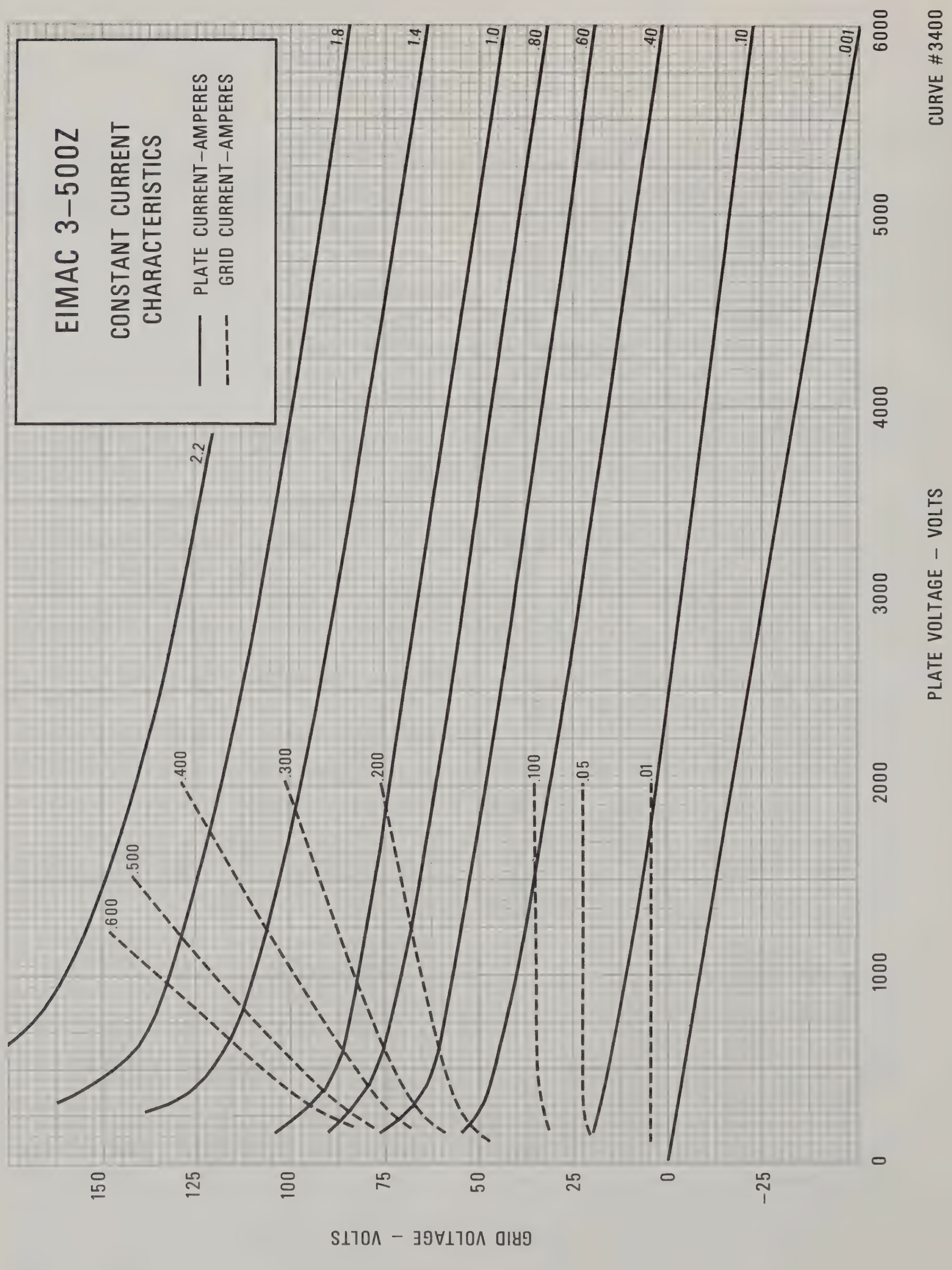
DIMENSIONAL DATA						
DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	--	3.438	--	--	87.33	--
B	--	--	0.355D	--	--	9.02
C	--	--	0.355	--	--	9.02
D	--	--	4.844	--	--	123.04
E	5.375	5.875	--	136.53	149.23	--
F	0.675	0.750	--	17.15	19.05	--
G	0.688	0.813	--	17.48	20.65	--
H	--	--	0.781	--	--	19.84
J	--	2.500D	--	--	63.50	--
K	--	--	30° TYP.	--	--	30° TYP.
L	0.185D	0.191D	--	4.70	4.85	--
M	--	--	1.250D	--	--	31.75D

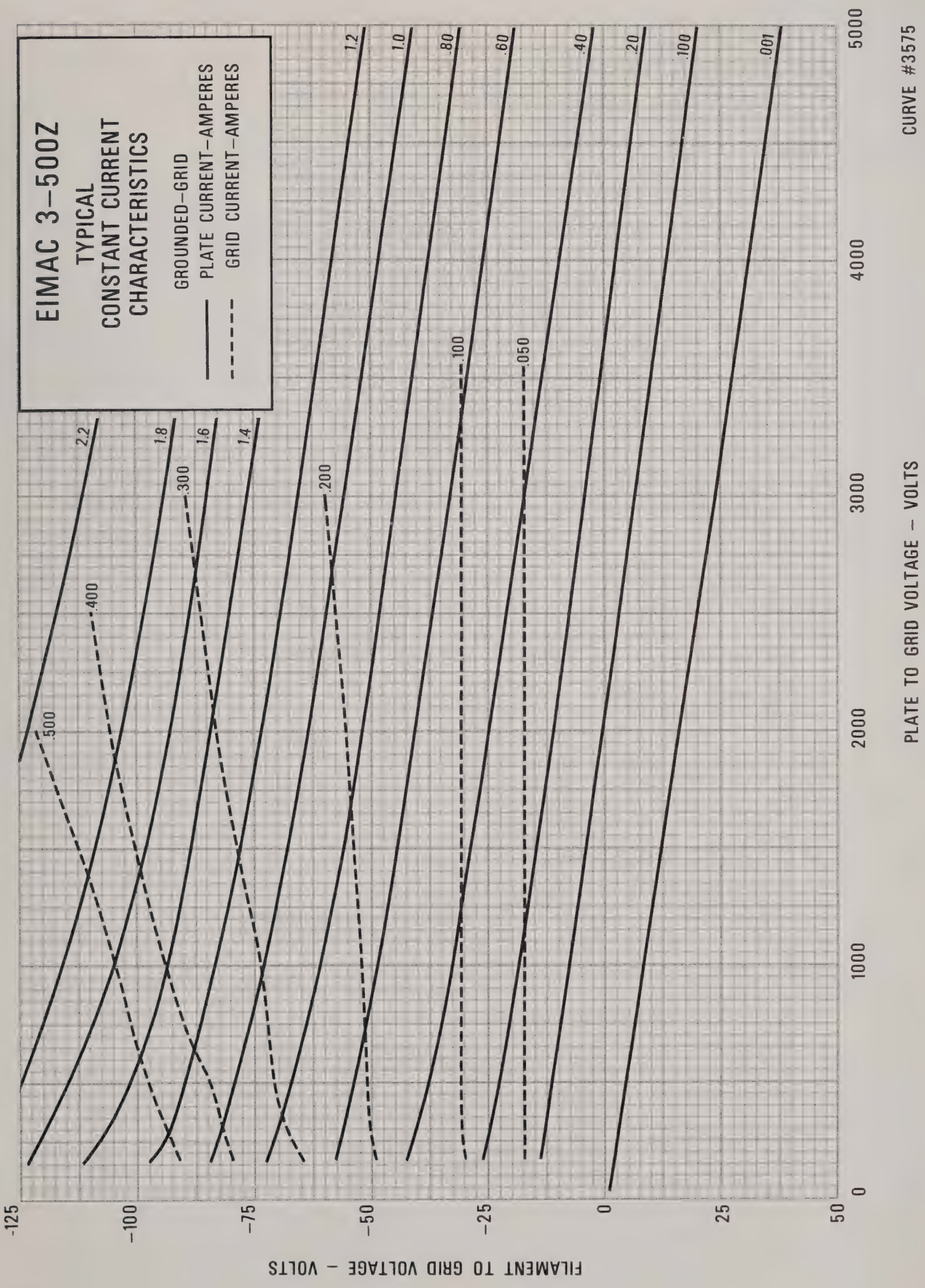
NOTE:

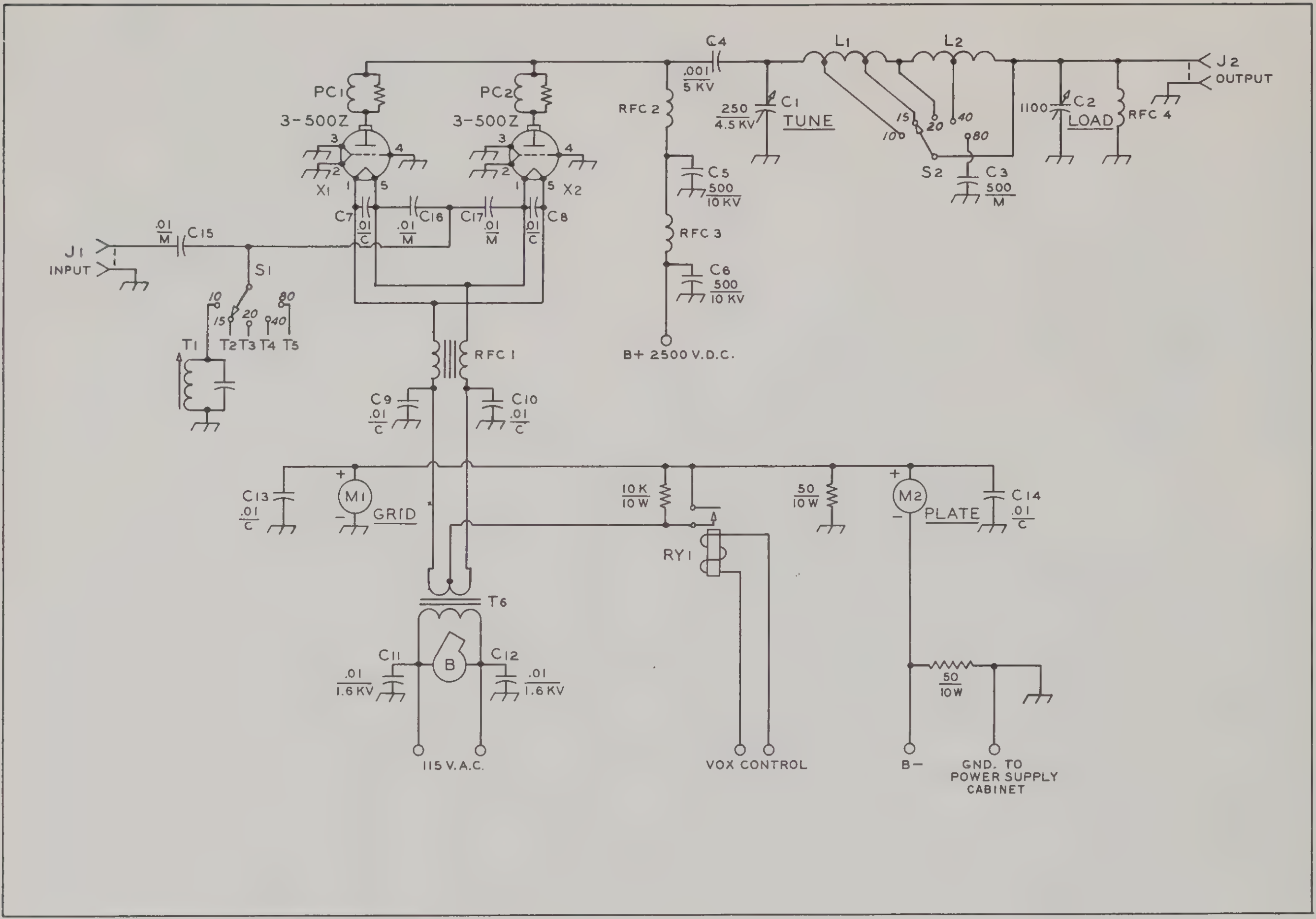
BASE PINS Ⓛ ARE SO ALIGNED THAT THEY CAN BE FREELY INSERTED INTO A GAUGE ¼" THICK WITH HOLE DIA'S OF .204 LOCATED ON TRUE CENTERS BY THE GIVEN DIMENSIONS Ⓚ & Ⓜ






EIMAC 3–500Z
CONSTANT CURRENT CHARACTERISTICS
PLATE CURRENT–AMPERES
GRID CURRENT–AMPERES
2.2
1.8
1.4
1.0
.80
.60
.40
.10
.001
.600
.500
.400
.300
.200
.100
.05
.01
PLATE VOLTAGE – VOLTS
0
1000
2000
3000
4000
5000
6000
GRID VOLTAGE – VOLTS
150
125
100
75
50
25
0
-25
CURVE #3400


EIMAC 3–500Z
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
GROUNDED–GRID
PLATE CURRENT–AMPERES
GRID CURRENT–AMPERES
2.2
1.8
1.6
1.4
1.2
1.0
.80
.60
.40
.20
.100
.001
.500
.400
.300
.200
.100
.050
FILAMENT TO GRID VOLTAGE – VOLTS
-125
-100
-75
-50
-25
0
25
50
PLATE TO GRID VOLTAGE – VOLTS
0
1000
2000
3000
4000
5000
CURVE #3575



TYPICAL CATHODE DRIVEN (GROUNDED GRID) AMPLIFIER CIRCUIT FOR TWO 3-500Z TUBES

C-1--250 pF, 4.5 kV (Johnson 154-16).

C-2--1100 pF, 3 section. Jackson Bros. LE-3-4595-380. (M. Swedgal, 258 Broadway, N.Y. 10007).

C-3--500 pF, 2.5 kV mica. Sangamo H-5347.

C-4--.001 µF, 5 kV. Centralab 858S-1000.

C-5, C-6--500 pF, 10 kV, TV "door knob" capacitor.

C-7 thru C-10--.01 µF, 600V ceramic capacitor (Centralab DD-103).

C-11, C-12--.01 µF, 1.6 kV ceramic capacitor (Centralab DD16-103).

C-13, C-14--.01 pF, 600V ceramic capacitor (Centralab DD-103).

C-15 thru C-17--.01 µF, 1 kV mica capacitor (Sangamo H-2210).

M-1--500 mAdc.

M-2--1000 mAdc.

RFC-1--50 µH. 14 bifilar turns #10 AWG enamelled wire wound on ferrite core, 5 inches long, ½ inch diameter. (Indiana General CF-503. Newark Electronics Co. catalog number 59F-1521). Notch core with file and break to length.

RFC-2--100 µH, 1 Adc. 112 turns #26 AWG, spacewound wire diameter on 1" diam., 6" long ceramic form (Centralab X-3022H insulator). Series resonant with terminals shorted to 24.5 MHz.

RFC-3--1.7 µH, 1 Adc. 20 turns #26 AWG wound on 100K, 2W resistor (J.W. Miller RFC-144).

RY-1--VOX operated SPST relay. Energized when transmit.

PC-1, PC-2--Three 100 ohm, 2W carbon resistors in parallel. Three turns #14 AWG, ½" diam., ¾" long in parallel with resistors. (Equivalent: Ohmite P-300 reduced to 3 turns).

J-1, J-2--Coaxial receptacle. UG-58A/U, for type N connector.

T-6--5 v at 30 amp. Chicago-Stancor P-4648.

X-1, X-2--EIMAC SK-410 socket and EIMAC SK-406 chimney.

B-Blower--13 cubic feet at 0.2 inch back pressure. Use #3 impeller at 3100 rpm. (Ripley 8472, Dayton 1C-180 or Redmond AK-2H-01AX).

CATHODE CIRCUIT COMPONENTS:

T-1 (10 meters)--0.15 µH. 4 turns #14 AWG on ½-inch form, ½-inch long. Parallel capacitance: 200 pF, 1 kV silver mica capacitor. Resonant at 28.7 MHz.

T-2 (15 meters)--0.15 µH, same as T-1. Resonant at 21.3 MHz with 470 pF, 1 kV silver mica capacitor.

T-3 (20 meters)--0.31 µH. 6 turns #14 AWG on ½-inch form, ½-inch long, slug tuned (National XR-50). Resonant at 14.2 MHz with 470 pF, 1 kV silver mica capacitor.

T-4 (40 meters)--0.31 µH, same as T-3. Resonant at 7.2 MHz with 940 pF. (Two 470 pF, 1 kV silver mica capacitors in parallel).

T-5 (80 meters)--1.3 µH. 13 turns #18 AWG on ½-inch diameter form, ½-inch long, slug tuned (National XR-50). Resonant at 3.8 MHz with 940 pF, same as T-4.

PLATE CIRCUIT COMPONENTS (for plate potential of 2500 Vdc), $R_L = 1725\Omega$:

The 10, 15 and 20 meter inductor (L_1) may be 10½ turns #8 AWG copper wire (or 3/16" tubing) 2" diam., 3" long. Ten meter tap is 5¼ turns from plate end; 15 meter tap is 7¼ turns from plate end. The 40-80 meter coil (L_2) may be 16 turns #10 AWG, 2½" diam., 4" long. Forty meter tap is 8 turns from junction with coil L-1.

S-2--Single pole ceramic switch, high voltage, 30° index. Radio Switch Corp. Model 86-A.

NOTE: For additional data on plate circuit design, write for Amateur Service Bulletin #30, "Pi and Pi-L Networks for Linear Amplifier Service"

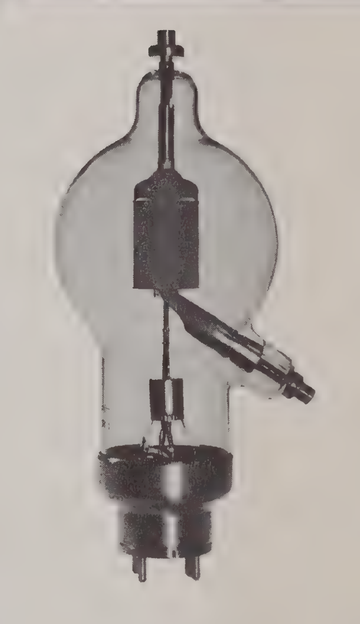
NOTE: B- of power supply is floating and grounded only through plate meter M_2 and the 50 ohm safety resistor. Cabinet of power supply should be grounded to amplifier cabinet as safety measure.

Eimac

EITEL-McCULLOUGH, INC.
SAN BRUNO · CALIFORNIA

750TL

MEDIUM-MU TRIODE
•
MODULATOR OSCILLATOR AMPLIFIER



The Eimac 750TL is a medium-mu power triode intended for use as an amplifier, oscillator, or modulator. It has a maximum plate dissipation rating of 750 watts and a maximum plate voltage rating of 10,000 volts at frequencies up to 40 Mc. The 750TL is cooled by air-circulation and radiation.

The 750TL in class-C r-f service will deliver up to 3000 watts plate power output with 125 watts driving power. Two 750TL's in class-AB_2 modulator service will deliver up to 3500 watts maximum-signal plate power output with 46 watts driving power.

GENERAL CHARACTERISTICS

▶ ELECTRICAL

Filament: Thoriated Tungsten	Min.	Nom.	Max.	
Voltage		7.5		volts
Current	20.0		22.7	amperes
Amplification Factor	14.5		16.5	
Direct Interelectrode Capacitances:				
Grid-Plate	5.0		7.0	μμf
Grid-Filament	7.0		10.0	μμf
Plate-Filament	0.9		1.5	μμf
Transconductance ($I_b = 250$ ma., $E_b = 5000$ v.)		3500		μmhos
Frequency for Maximum Ratings			40	mc

MECHANICAL

Base	Special 4-pin
Connections	See outline drawing
Socket	Johnson type No. 124-214 or equivalent
Mounting Position	Vertical, base down or up
Cooling	Air-circulation and radiation
Recommended Plate and Grid Heat-Dissipating Connectors	Eimac HR-8
Maximum Overall Dimensions:	
Length	17.0 inches
Diameter	7.13 inches
Net Weight (Average)	2.9 pounds
Shipping Weight (Average)	13 pounds

AUDIO-FREQUENCY POWER AMPLIFIER OR MODULATOR

Class-AB_2 (Sinusoidal wave)

MAXIMUM RATINGS (Per tube)

D-C PLATE VOLTAGE	10,000 MAX. VOLTS
D-C PLATE CURRENT	1000 MAX. MA
PLATE DISSIPATION	750 MAX. WATTS
GRID DISSIPATION	100 MAX. WATTS

TYPICAL OPERATION (Two tubes unless otherwise specified)

D-C Plate Voltage	4000	5000	6000	volts
D-C Grid Voltage[1]	—230	—320	—390	volts
Zero-Signal D-C Plate Current	250	200	166	ma.
Max-Signal D-C Plate Current	950	860	834	ma
Effective Load, Plate-to-Plate	8270	12,300	16,300	ohms
Peak A-F Grid Voltage (per tube)	490	560	650	volts
Max-Signal Driving Power*	38	28	46	watts
Max-Signal Plate Power Input	3800	4300	5000	watts
Max-Signal Plate Power Output	2300	2800	3500	watts

[1] Adjust to stated zero-signal plate current.

RADIO-FREQUENCY POWER AMPLIFIER OR OSCILLATOR

Class-C Telegraphy or FM Telephony (Key-down conditions, per tube)

MAXIMUM RATINGS (Frequencies up to 40 Mc.)

D-C PLATE VOLTAGE	10,000 MAX. VOLTS
D-C PLATE CURRENT	1000 MAX. MA
PLATE DISSIPATION	750 MAX. WATTS
GRID DISSIPATION	100 MAX. WATTS

TYPICAL OPERATION (Frequencies up to 40 Mc.)

D-C Plate Voltage	3000	4000	5000	6000	volts
D-C Grid Voltage	—350	—450	—550	—700	volts
D-C Plate Current	713	625	600	625	ma
D-C Grid Current*	120	90	90	105	ma
Peak R-F Grid Voltage	805	885	985	1040	volts
Driving Power*	97	83	86	125	watts
Grid Dissipation*	55	40	38	50	watts
Plate Power Input	2140	2500	3000	3750	watts
Plate Power Output	1390	1750	2250	3000	watts

PLATE-MODULATED RADIO-FREQUENCY AMPLIFIER

CLASS-C TELEPHONY (Carrier conditions, per tube)

MAXIMUM RATINGS (Frequencies up to 40 Mc.)

D-C PLATE VOLTAGE	8000 MAX. VOLTS
D-C PLATE CURRENT	800 MAX. MA
PLATE DISSIPATION	500 MAX. WATTS
GRID DISSIPATION	100 MAX. WATTS

TYPICAL OPERATION (Frequencies up to 40 Mc.)

D-C Plate Voltage	3000	4000	5000	6000	volts
D-C Grid Voltage	—500	—650	—800	—950	volts
D-C Plate Current	415	400	400	415	ma
D-C Grid Current*	55	60	55	60	ma
Peak R-F Grid Voltage	830	985	1150	1330	volts
Driving Power*	45	50	60	75	watts
Grid Dissipation*	15	15	16	20	watts
Plate Power Input	1250	1600	2000	2500	watts
Plate Power Output	750	1100	1500	2000	watts

*Approximate values

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER "TYPICAL OPERATION", POSSIBLY EXCEEDING THE MAXIMUM RATINGS GIVEN FOR CW SERVICE, WRITE EITEL-McCULLOUGH, INC. FOR INFORMATON AND RECOMMENDATIONS.

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▶ Indicates change from sheet dated 6-2-52

APPLICATION

MECHANICAL

Mounting—The 750TL must be mounted vertically, base down or up. The plate and grid leads should be flexible. The tube must be protected from vibration and shock.

Cooling—Heat Dissipating Connectors (Eimac HR-8 or equivalent) must be used at the plate and grid terminals of the 750TL. Unobstructed circulation of air around the tube is required in sufficient quantity to prevent the seal temperatures from exceeding 225° C. Forced ventilation of compartments or equipment in which the tube is located is usually desirable. Forced movement of air across the tube seals and envelope is always beneficial, though not necessarily required.

Tube temperatures may be measured with the aid of "Tempilaq", a temperature-sensitive lacquer manufactured by the Tempil Corporation, 132 West 22nd Street, New York 11, N. Y.

ELECTRICAL

Filament Voltage—For maximum tube life the filament voltage, as measured directly at the filament pins, should be the rated value of 7.5 volts. Variations should be kept within the range of 7.5 to 7.85 volts. All four socket terminals should be used, placing two in parallel for each filament connection.

Bias Voltage—Although there is no maximum limit placed on the bias voltage which may be used with the 750TL, there is little advantage in using bias voltages in excess of those given under "Typical Operation", except in certain very specialized applications.

When grid-leak bias is used, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation, and the grid-leak resistor should be made adjustable to facilitate maintaining the bias voltage and plate current at the desired value from tube to tube.

Grid Dissipation—Grid dissipation may be calculated from the following expression:

$$P_g = e_{cmp} I_c$$

where: P_g = Grid dissipation,
e_{cmp} = Peak positive grid voltage, and
I_c = D-C grid current.

e_{cmp} may be measured by means of a suitable peak voltmeter connected between filament and grid.[1] In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating of 100 watts under any conditions of loading.

Plate Dissipation—Under normal operating conditions, the plate dissipation of the 750TL should not be allowed to exceed the maximum rating. Plate dissipation in excess of the maximum rating is permissible for short periods of time, such as during tuning procedures.

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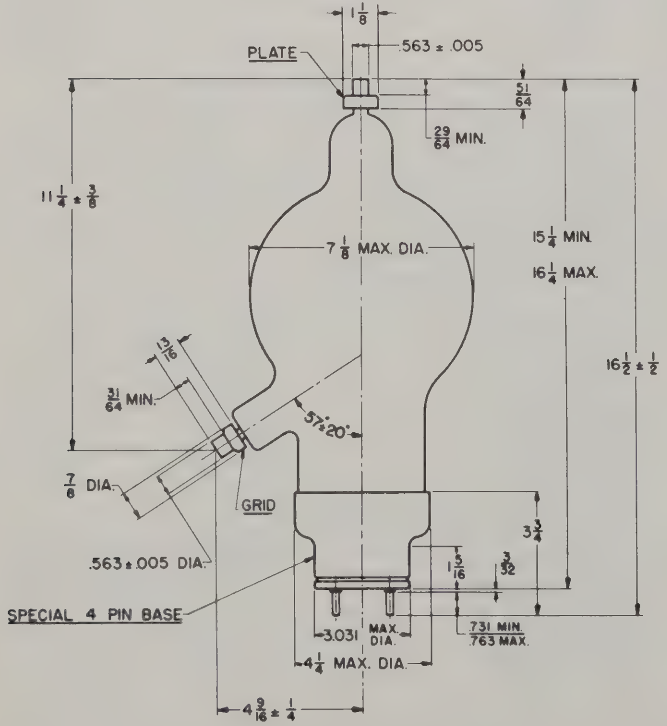
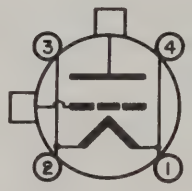
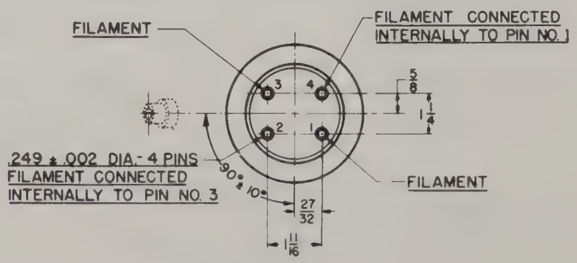
[1] For suitable peak v.t.v.m. circuits see, for instance, "Vacuum Tube Ratings", Eimac News, January, 1945. This article is available in reprint form on request.





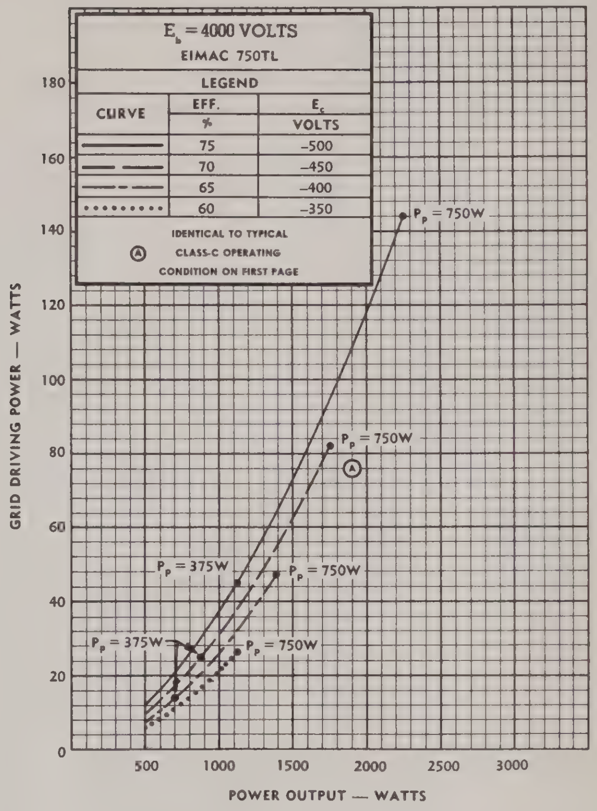

FILAMENT
FILAMENT CONNECTED INTERNALLY TO PIN NO. 1
3
4
2
1
5/8
1 1/4
.249 ± .002 DIA.- 4 PINS
FILAMENT CONNECTED INTERNALLY TO PIN NO. 3
90° ± 10°
FILAMENT
27/32
1 11/16

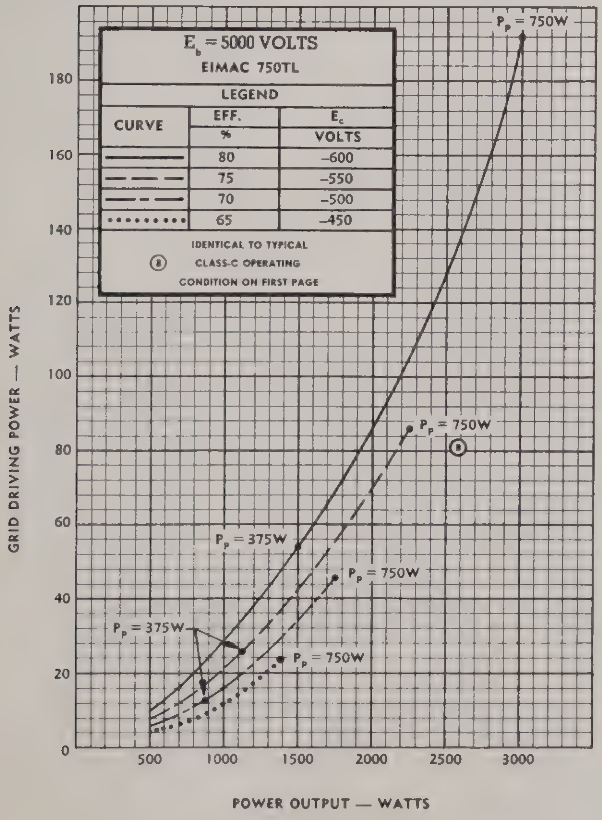
BOTTOM VIEW

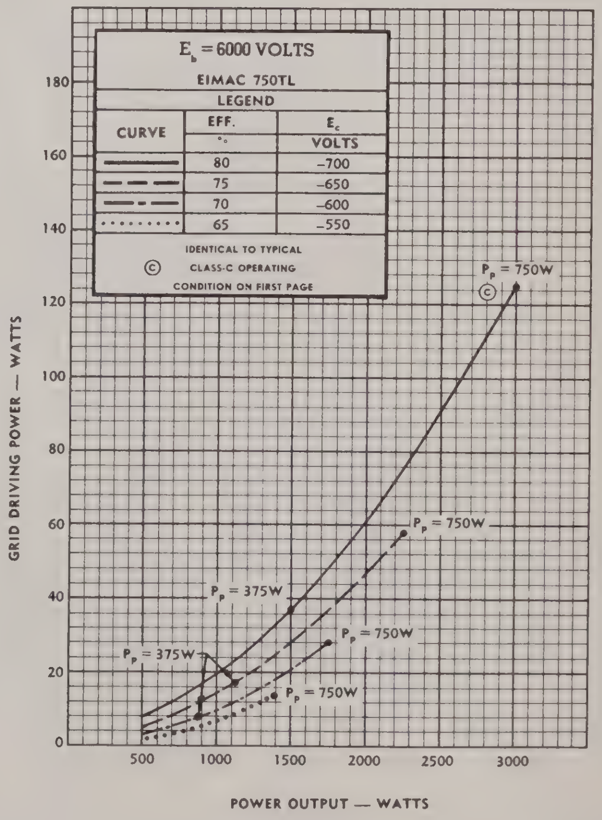
ALL DIMENSIONS IN INCHES

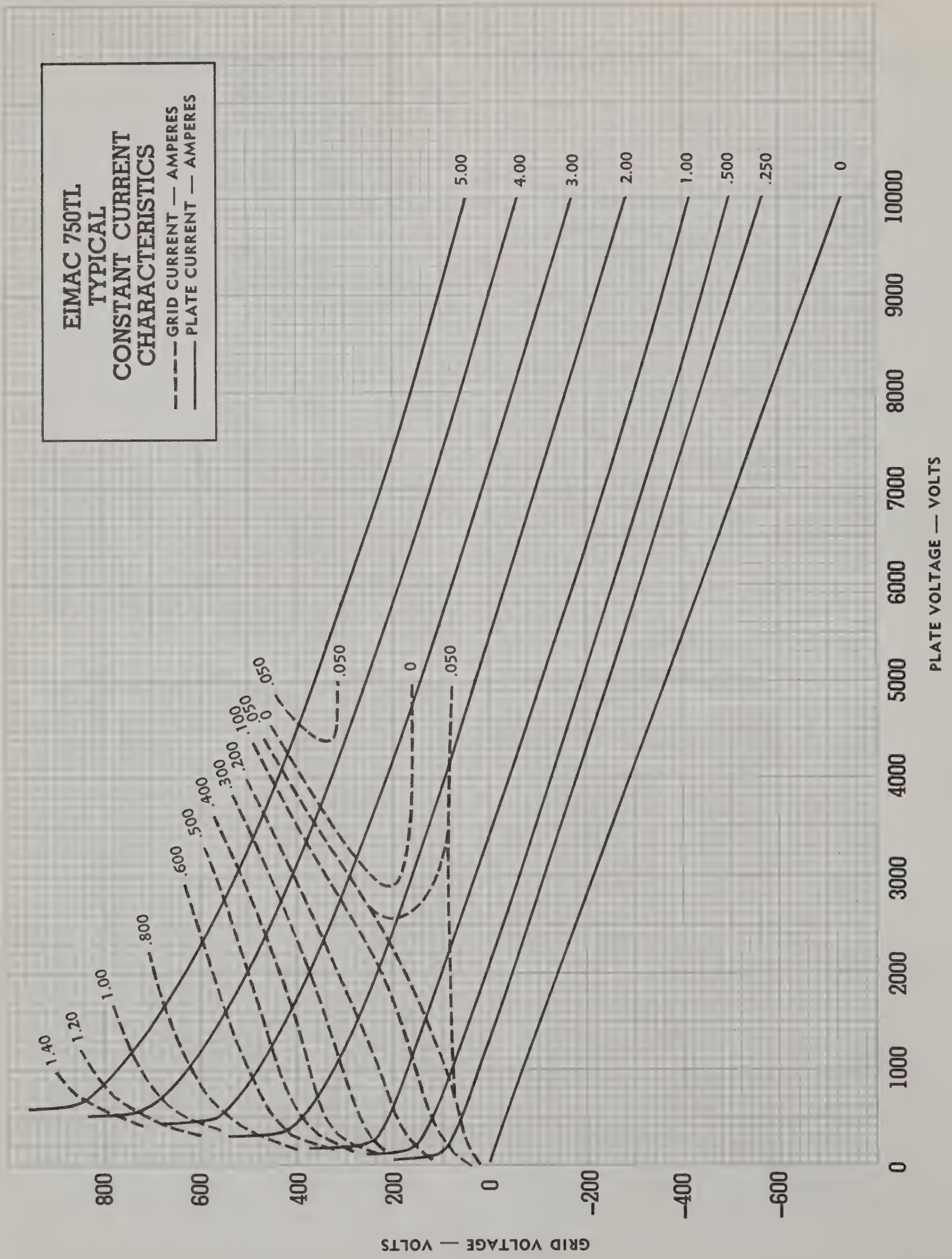
DRIVING POWER vs. POWER OUTPUT

The three charts on this page show the relationship of plate efficiency, power output and approximate grid driving power at plate voltages of 4000, 5000 and 6000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by Pp. Points A, B and C are identical to the typical Class-C operating conditions shown on the first page under 4000, 5000 and 6000 volts, respectively.









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Eimac®

EITEL-McCULLOUGH, INC.
SAN BRUNO · CALIFORNIA

1000T

HIGH-MU TRIODE

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MODULATOR
OSCILLATOR
AMPLIFIER

The Eimac 1000T is a high-mu power triode intended for use as a modulator, oscillator, or amplifier. The tube has a maximum plate dissipation rating of 1000 watts, and a maximum plate voltage rating of 7500 volts at frequencies up to 50 Mc. Cooling is by forced air and radiation.

The 1000T in Class-C r-f service will deliver up to 3000 watts plate power output with 60 watts driving power. Two 1000T's in Class AB_2 modulator service will deliver up to 4600 watts maximum-signal plate power output with 60 watts driving power.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten	
Voltage	7.5 volts ± 5%
Current	15.5 amperes
Amplification Factor (Average)	35
Direct Interelectrode Capacitances (Average)	
Grid-Plate	5.1 μμf
Grid-Filament	9.3 μμf
Plate-Filament	0.5 μμf
Transconductance (I_b=750ma., E_b=6000v.)	9050 μmhos
Highest Frequency for Maximum Ratings	50 Mc

MECHANICAL

Base	50-watt jumbo 4-pin with air-conduction pipe
Connections	See outline drawing
Socket	Johnson type No. 123-211 or equivalent
Mounting Position	Vertical, base down or up
Cooling	Forced air and radiation
Maximum Temperature of Grid and Plate Seals	225°C
Recommended Grid and Plate Heat Dissipating Connectors	Eimac HR-9
Maximum Dimensions:	
Seated Height	12.3 inches
Diameter	5.13 inches
Net Weight	1.25 pounds
Shipping Weight (Average)	6.25 pounds

AUDIO-FREQUENCY POWER AMPLIFIER OR MODULATOR

Class-AB_2

MAXIMUM RATINGS (Per tube)

D-C PLATE VOLTAGE	7500 MAX. VOLTS
D-C PLATE CURRENT	750 MAX. MA
PLATE DISSIPATION	1000 MAX. WATTS
GRID DISSIPATION	80 MAX. WATTS

TYPICAL OPERATION (Sinusoidal wave, two tubes unless otherwise specified)

D-C Plate Voltage	4000	5000	6000	volts
D-C Grid Voltage[1]	–85	–125	–160	volts
Zero-Signal D-C Plate Current	335	270	220	ma
Max-Signal D-C Plate Current	1.25	1.14	1.05	amps
Effective Load, Plate-to-Plate	6250	9200	13,300	ohms
Peak A-F Grid Voltage (per tube)	260	290	335	volts
Max-Signal Driving Power*	35	37	60	watts
Max-Signal Plate Power Input	5000	5700	6300	watts
Max-Signal Plate Power Output	3000	3700	4600	watts

[1] Adjust to stated Zero-Signal Plate Current.

RADIO-FREQUENCY POWER AMPLIFIER OR OSCILLATOR

Class-C Telegraphy or FM Telephony (Key-down conditions, per tube)

MAXIMUM RATINGS (Frequencies up to 50 Mc.)

D-C PLATE VOLTAGE	7500 MAX. VOLTS
D-C PLATE CURRENT	750 MAX. MA
PLATE DISSIPATION	1000 MAX. WATTS
GRID DISSIPATION	80 MAX. WATTS

TYPICAL OPERATION (Frequencies up to 50 Mc.)

D-C Plate Voltage	3000	4000	5000	6000	volts
D-C Grid Voltage	–150	–150	–225	–350	volts
D-C Plate Current	750	713	667	667	ma
D-C Grid Current*	90	100	87	110	ma
Peak R-F Grid Voltage	350	365	420	610	volts
Driving Power*	30	33	33	60	watts
Grid Dissipation*	21	19	14	25	watts
Plate Power Input	2250	2850	3335	4000	watts
Plate Power Output	1350	1850	2335	3000	watts

PLATE-MODULATED RADIO-FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS (Frequencies up to 50 Mc.)

D-C PLATE VOLTAGE	6000 MAX. VOLTS
D-C PLATE CURRENT	600 MAX. MA
PLATE DISSIPATION	665 MAX. WATTS
GRID DISSIPATION	80 MAX. WATTS

TYPICAL OPERATION (Frequencies up to 50 Mc.)

D-C Plate Voltage	4000	5000	6000	volts
D-C Grid Voltage	–300	–400	–500	volts
D-C Plate Current	600	600	600	ma
D-C Grid Current*	80	90	95	ma
Peak R-F Grid Voltage	540	660	775	volts
Driving Power*	45	60	75	watts
Grid Dissipation*	20	24	25	watts
Plate Power Input	2400	3000	3600	watts
Plate Power Output	1735	2335	2935	watts

*Approximate values

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER "TYPICAL OPERATION", POSSIBLY EXCEEDING THE MAXIMUM RATINGS GIVEN FOR CW SERVICE, WRITE EITEL-McCULLOUGH, INC., FOR INFORMATION AND RECOMMENDATIONS.

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APPLICATION

MECHANICAL

Mounting—The 1000T must be mounted vertically. The base may be either down or up. The leads to the plate and grid terminals should be flexible, and the tube must be protected from vibration and shock.

Cooling—The envelope and seals of the 1000T require forced-air cooling. Air-conduction pipes are provided in the base of the tube and in the HR-9 plate and grid Heat-Dissipating Connectors. Two cubic feet of air per minute supplied to each of these pipes will satisfy the cooling requirements of the seals. An 8- or 10-inch fan located approximately a foot from the tube will provide sufficient cooling air for the envelope. Air must be supplied to the tube when plate and grid voltages are applied, and must be continued until these voltages are removed. In some cases, particularly in locations where the ambient temperature is high, or where the free circulation of air is impeded, cooling air must be supplied when filament voltage is applied, and continued for two or more minutes after all voltages are removed.

The temperature of the grid and plate seals must not be allowed to exceed 225°C. A convenient accessory for the measurements of these temperatures is "Tempilaq", a temperature-sensitive lacquer manufactured by the Tempil Corporation, 132 W. 22nd St., New York 11, N. Y.

ELECTRICAL

Filament—All four socket terminals should be used, putting two in parallel for each filament connection.

Bias Voltage—The maximum limit on bias voltages which may be used with the 1000T is considerably above those listed in "Typical Operation." Where bias is obtained by a grid leak, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation.

Plate Voltage—The rated maximum d-c plate voltage of 7500 volts applies at frequencies up to 50 Mc. Above that frequency the tube must be operated at lower d-c voltages. In most cases there is little advantage in using plate supply voltages higher than those given under "Typical Operation" for the power output desired.

Grid Dissipation—Grid dissipation may be assumed to be the product of the d-c grid current and the peak positive cathode-to-grid voltage. This assumption is sufficiently accurate for the purpose of determining that the 1000T is operating within its maximum rated grid dissipation of 80 watts.

Plate Dissipation—Under normal operating conditions, the power dissipated by the plate of the 1000T should not be allowed to exceed 1000 watts. Plate dissipation in excess of the maximum rating is permissible for short periods of time, such as during tuning procedures.

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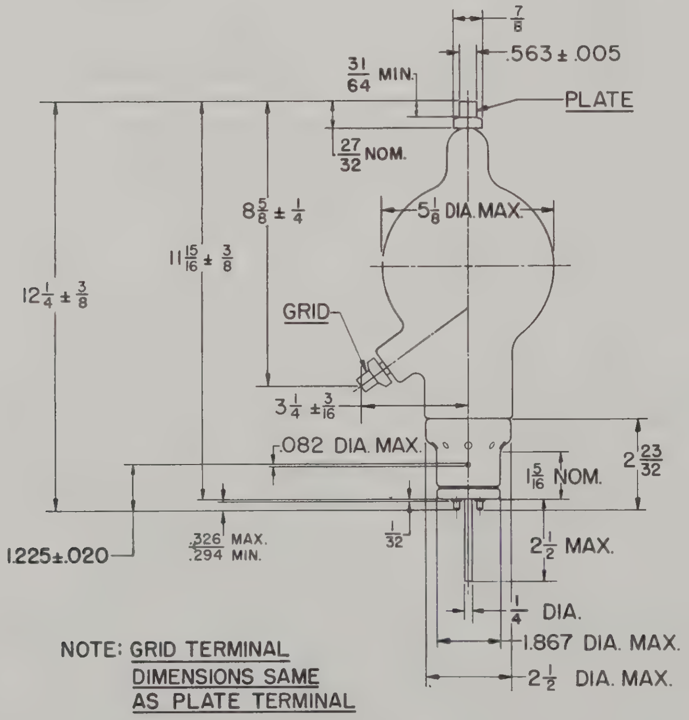

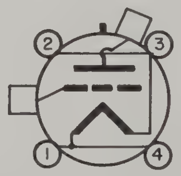

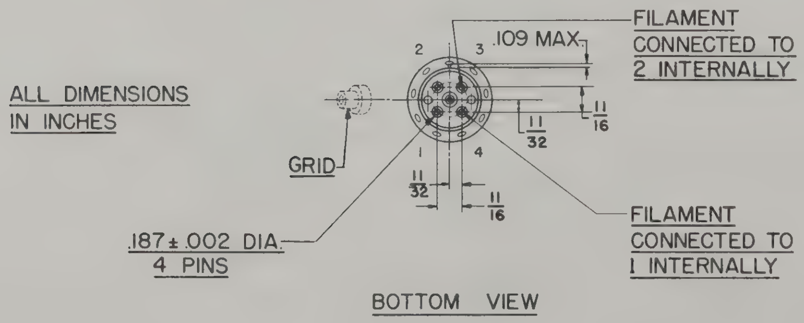

▶ Indicates change from sheet dated 3-15-52

DRIVING POWER vs. POWER OUTPUT

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The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 4000, 5000 and 6000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 4000, 5000, and 6000 volts respectively.

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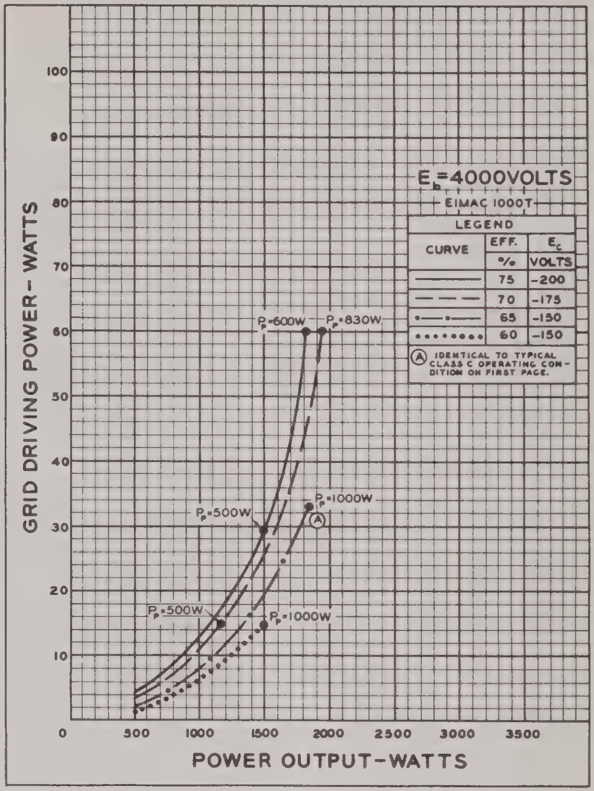

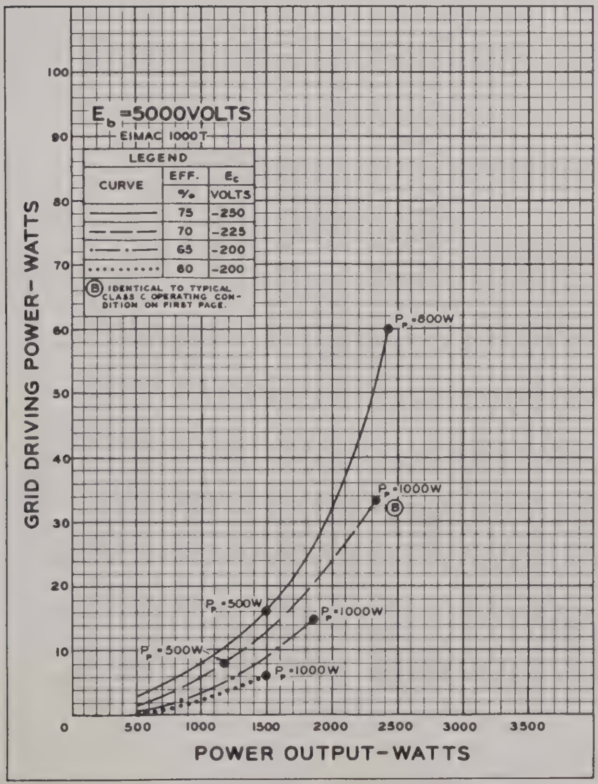

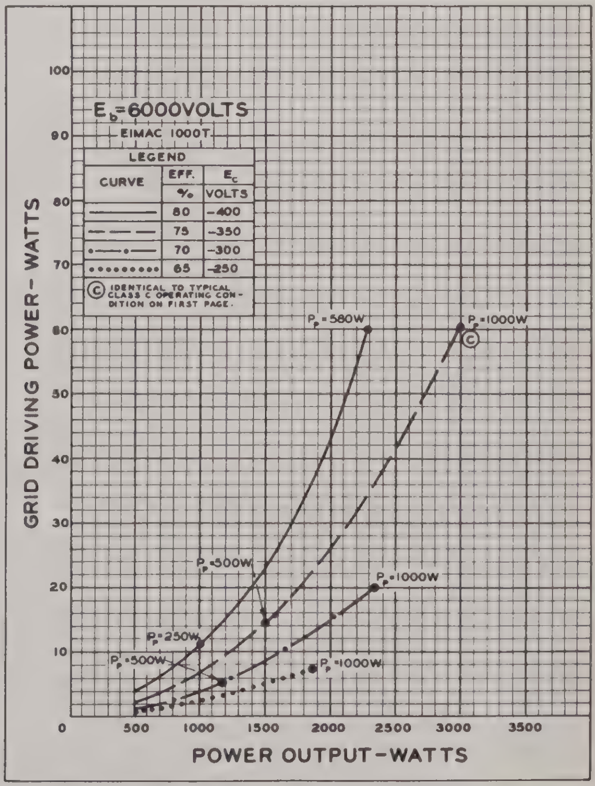

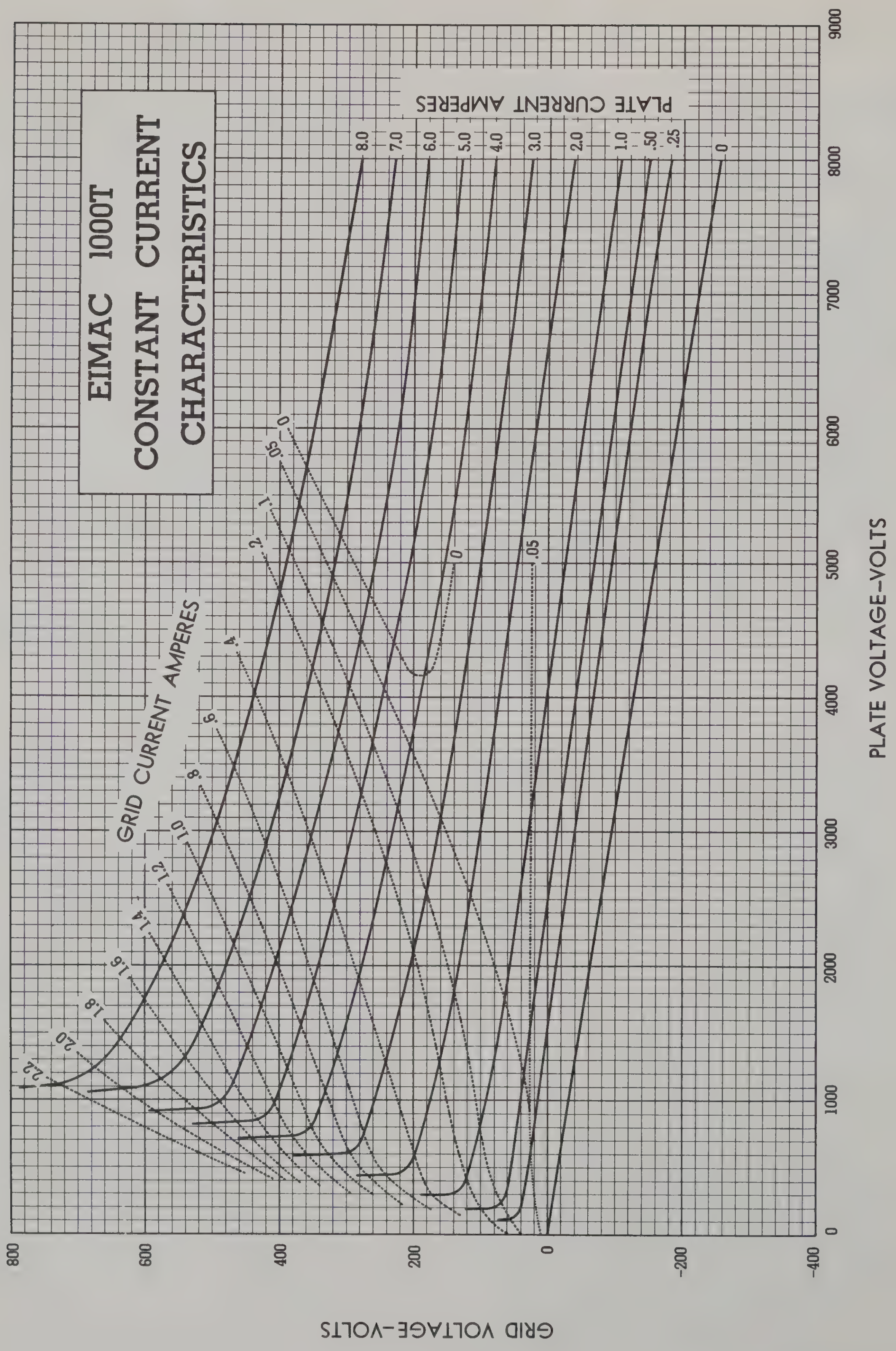

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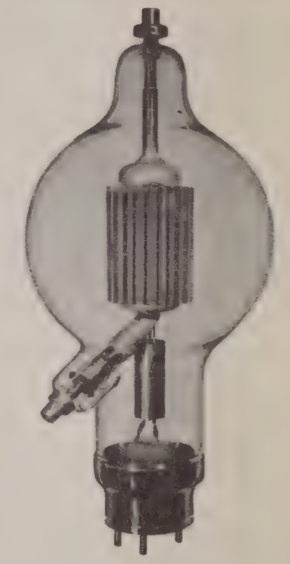
EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

2000T

MEDIUM-MU TRIODE

MODULATOR
OSCILLATOR
AMPLIFIER



The 2000T is a medium-mu, high-vacuum transmitting triode intended for amplifier, oscillator and modulator service. It has a maximum plate dissipation rating of 2000 watts. Cooling of the 2000T is accomplished by radiation from the plate, which operates at a visibly red temperature at maximum dissipation, and by means of forced air circulation around the envelope and at the seals.

GENERAL CHARACTERISTICS

▶ ELECTRICAL

Filament: Thoriated Tungsten

Voltage	10.0 volts
Current	23.5 amperes

Note: Dual connections for each filament lead are provided within the base of the tube (see basing diagram). Corresponding socket terminals must be connected in parallel to provide proper distribution of filament and R-F charging currents.

Amplification Factor (Average)	23
Direct Interelectrode Capacitances (Average)	
Grid-Plate	8.5 $\mu\mu$fd.
Grid-Filament	12.7 $\mu\mu$fd.
Plate-Filament	1.7 $\mu\mu$fd.
Transconductance (i_b = 1.75 amp., E_b = 6000 v.)	11,000 μmhos
Frequency for Maximum Ratings	40 Mc.

▶ MECHANICAL

Base	Special 4-pin, No. 5006B
Basing	RMA type 4BD
Mounting	Vertical, base down or up
Cooling (See "Cooling" under "Application")	Radiation and forced air
Recommended Heat Dissipating Connectors:	
Plate	Eimac HR-8
Grid	Eimac HR-8
Maximum Overall Dimensions:	
Length	17.75 inches
Diameter	8.125 inches
Net weight	3.5 pounds
Shipping weight (Average)	13 pounds

▶ AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class AB_2 (Sinusoidal wave, two tubes unless otherwise specified)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	8000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT, PER TUBE	1.75 MAX. AMPS.
PLATE DISSIPATION, PER TUBE	2000 MAX. WATTS

TYPICAL OPERATION—2 TUBES

D-C Plate Voltage	4000	5000	6000	7000	Volts
D-C Grid Voltage (approx.)*	—140	—180	—230	—280	Volts
Zero-Signal D-C Plate Current	400	400	400	300	Ma.
Max-Signal D-C Plate Current	2.30	2.20	2.00	1.80	Amps
Effective Load, Plate-to-Plate	3400	5000	7000	9200	Ohms
Peak A-F Grid Input Voltage (per tube)	500	520	580	600	Volts
Max-Signal Peak Driving Power	300	280	380	350	Watts
Max-Signal Nominal Driving Power (approx.)	150	140	190	175	Watts
Max-Signal Plate Power Output	5200	7000	8000	8600	Watts

*Adjust to give stated zero-signal plate current

▶ RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR

Class-C Telegraphy or FM Telephony (Key-down conditions, per tube)

MAXIMUM RATINGS (Frequencies below 40 Mc.)

D-C PLATE VOLTAGE	8000 MAX. VOLTS
D-C PLATE CURRENT	1.75 MAX. AMPS.
PLATE DISSIPATION	2000 MAX. WATTS
GRID DISSIPATION	150 MAX. WATTS

TYPICAL OPERATION, PER TUBE* (Frequencies below 40 Mc.)

D-C Plate Voltage	5000	6000	7000	Volts
D-C Grid Voltage	—350	—500	—600	Volts
D-C Plate Current	1.35	1.35	1.15	Amps.
D-C Grid Current	175	165	120	Ma.
Peak R-F Grid Input Voltage	840	1000	1060	Volts
Driving Power (approx.)	140	160	115	Watts
Grid Dissipation	85	82	55	Watts
Plate Power Input	6750	8000	8000	Watts
Plate Dissipation	2000	2000	2000	Watts
Plate Power Output	4750	6000	6000	Watts

*The performance figures listed under Typical Operation are for radio frequencies up to the VHF region and are obtained by calculation from the characteristic tube curves and confirmed by direct tests. The driving power given includes power taken by the tube grid and the bias circuit. The driving power and output power do not allow for losses in the associated resonant circuits. These losses are not included because they depend principally upon the design and choice of the circuit components.

▶ PLATE MODULATED RADIO FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS (Frequencies below 40 Mc.)

D-C PLATE VOLTAGE	6000 MAX. VOLTS
D-C PLATE CURRENT	1.4 MAX. AMPS.
PLATE DISSIPATION	1350 MAX. WATTS
GRID DISSIPATION	150 MAX. WATTS

TYPICAL OPERATION, PER TUBE* (Frequencies below 40 Mc.)

D-C Plate Voltage	4000	5000	6000	Volts
D-C Plate Current	1.25	1.20	1.13	Amps.
Total Bias Voltage	—600	—700	—800	Volts
Fixed Bias Voltage	—300	—330	—375	Volts
Grid Resistor	1500	2000	2500	Ohms
D-C Grid Current	200	185	170	Ma.
Peak R-F Grid Input Voltage (approx.)	1140	1240	1320	Volts
Driving Power (approx.)	228	230	225	Watts
Grid Dissipation	108	100	88	Watts
Plate Power Input	5000	6000	6750	Watts
Plate Dissipation	1350	1350	1350	Watts
Plate Power Output	3650	4650	5400	Watts

*The performance figures listed under Typical Operation are for radio frequencies up to the VHF region and are obtained by calculation from the characteristic tube curves and confirmed by direct tests. The driving power given includes power taken by the tube grid and the bias circuit. The driving power and output power do not allow for losses in the associated resonant circuits. These losses are not included because they depend principally upon the design and choice of the circuit components.

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▶ Indicates change from sheet dated 4-1-46

APPLICATION

MECHANICAL

Mounting—The 2000T must be mounted vertically, base up or base down. Flexible connecting straps should be provided between the grid and plate terminals and the external grid and plate circuits. The tube must be protected from severe vibration and shock.

Cooling—Forced-air cooling is required on the envelope and also in the base of the tube. Envelope cooling may be accomplished by locating an ordinary 8- or 10-inch fan about one foot from the tube and directing the air at the middle of the envelope.

Base cooling requires an air flow of 2½ cu. ft. per min. directed up through the bottom of the base toward the filament press. The base of the tube is provided with a 1-inch diameter hole for this purpose. If a socket is used with a 1-inch diameter matching hole and the manifold is of the same diameter, a static pressure of less than 0.1 inch of water is required at the manifold to provide the 2½ cu. ft. per min.

One type of socket provides a ¼ inch diameter pipe for the air inlet to the base. With this type of socket a static pressure of 5½ inches of water is required at the pipe to obtain the necessary 2½ cu. ft. per min. volume.

Suitable electrical interlocks should be provided to remove the plate and filament voltages in the event that the supply of cooling air is interrupted.

ELECTRICAL

Filament Voltage—For maximum tube life the filament voltage, as measured directly at the filament pins, should be the rated value of 10 volts. Unavoidable variations in filament voltage must be kept within the range from 9.5 to 10.5 volts. All four socket terminals should be used, putting two in parallel for each filament connection.

Bias Voltage—Although there is no maximum limit on the bias voltage which may be used on the 2000T there is little advantage in using bias voltages in excess of those given under "Typical Operation," except in certain very specilaized applications. Where bias is obtained by a grid leak, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation.

Plate Voltage—The plate supply voltage for the 2000T should not exceed 8000 volts. In most cases there is little advantage in using plate-supply voltages higher than those given under "Typical Operation" for the power output desired.

Grid Dissipation—The power dissipated by the grid of the 2000T must not exceed 150 watts. Grid dissipation may be calculated from the following expression:

$$P_g = e_{cmp} I_c$$

where P_g = Grid dissipation,
e_{cmp} = Peak positive grid voltage, and
I_c = D-c grid current.

e_{cmp} may be measured by means of a suitable peak voltmeter connected between filament and grid.[1] In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading.

Plate Dissipation—Under normal operating conditions, the power dissipated by the plate of the 2000T should not be allowed to exceed 2000 watts. Plate dissipation in excess of the maximum rating is permissible for short periods of time, such as during tuning procedures.

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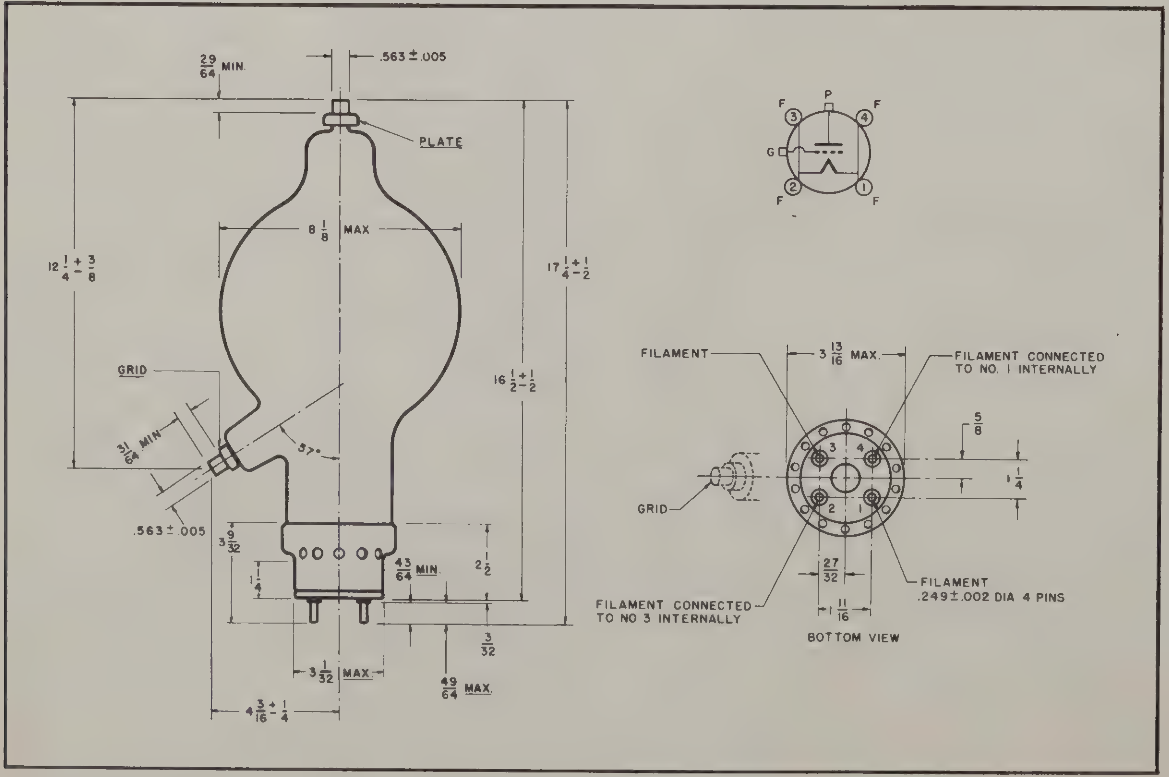
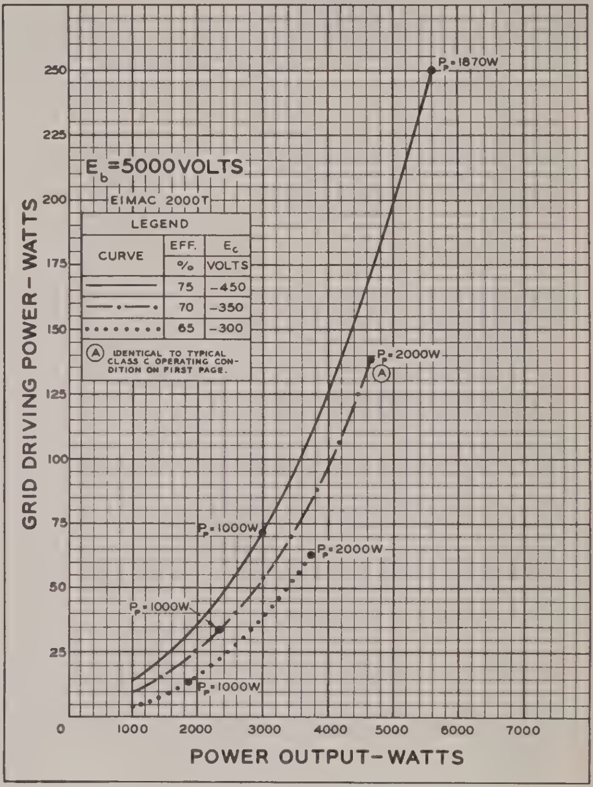
[1] For suitable peak v.t.v.m. circuits see, for instance, "Vacuum Tube Ratings," **Eimac News**, January, 1945. This article is available in reprint form on request.

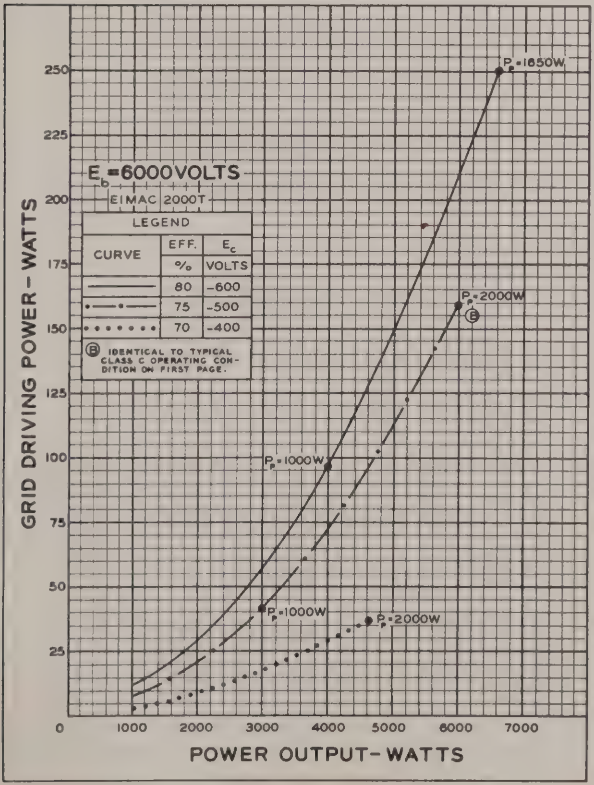


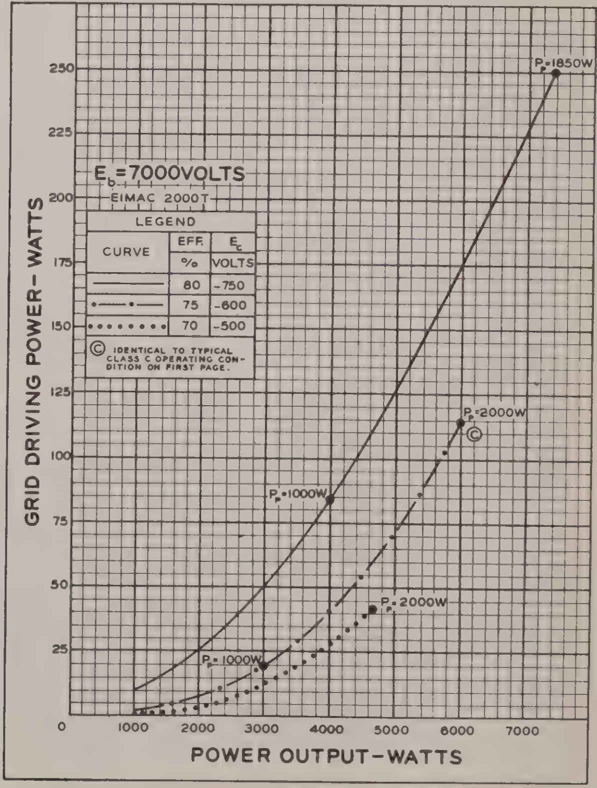
DRIVING POWER vs. POWER OUTPUT

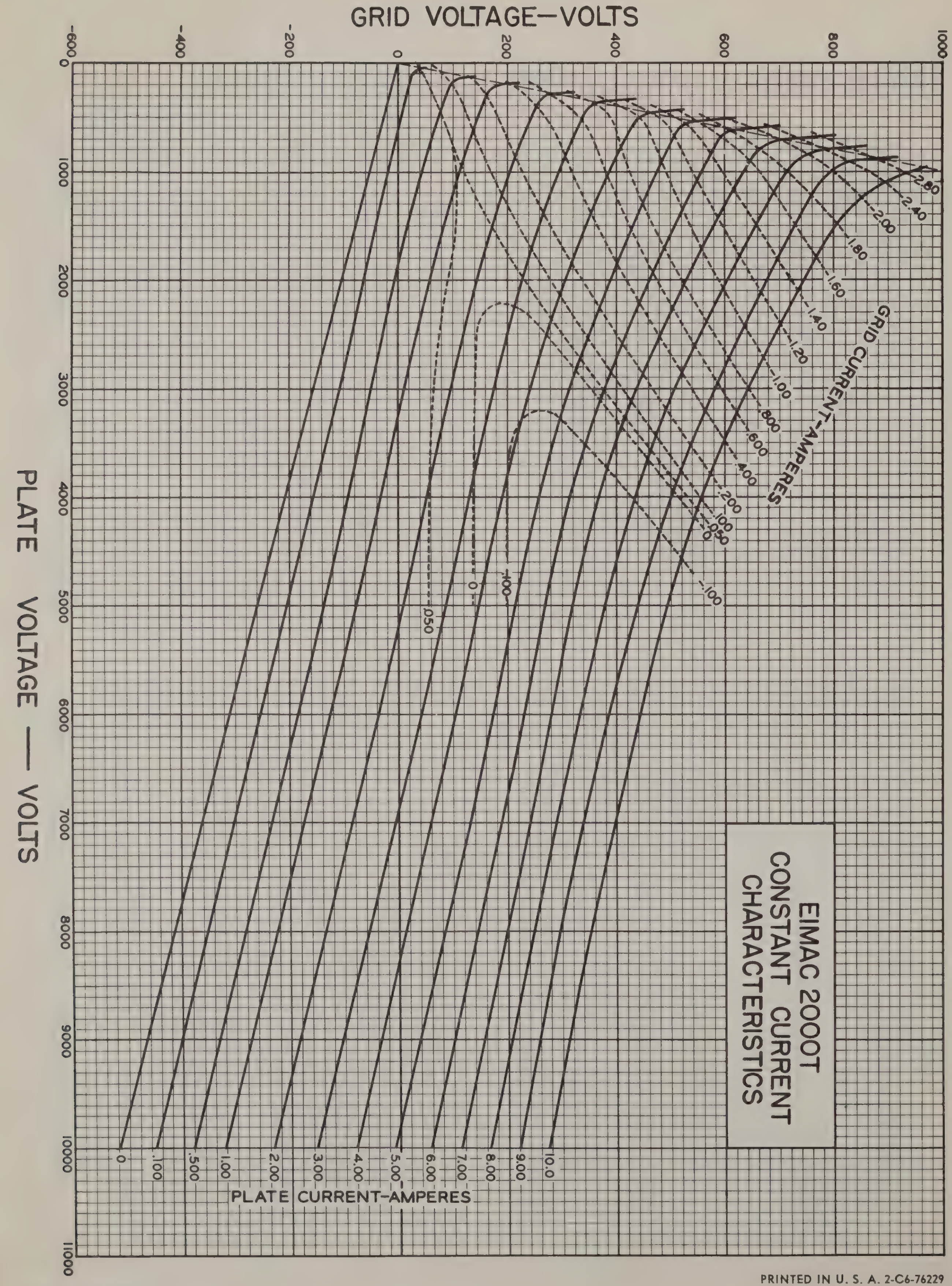
The three charts on this page show the relationship of plate efficiency, power output and grid driving power at plate voltages of 5000, 6000, and 7000 volts. These charts show combined grid and bias losses only. The driving power and power output figures do not include circuit losses. The plate dissipation in watts is indicated by P_p.

Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 5000, 6000, and 7000 volts respectively.









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Eimac®

EITEL-McCULLOUGH, INC.
SAN CARLOS · CALIFORNIA

3W5000F3

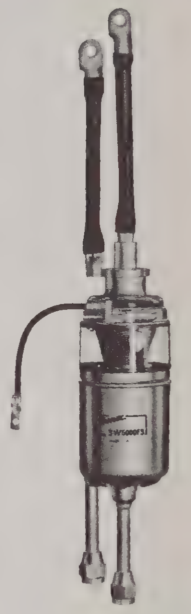
MEDIUM MU-TRIODE

The Eimac 3W5000F3 is a water-cooled, medium-mu power triode intended for amplifier, oscillator or modulator service. It has a maximum plate dissipation rating of 5000 watts and is capable of high output at relatively low plate voltages. A single 3W5000F3 will deliver a radio frequency plate power-output of 7500 watts at a plate voltage of 4000 volts.

The tube is equipped with flexible filament and grid leads which simplifies socketing and equipment design for industrial and communication frequencies below 30 Mc.

NOTE: The 3W5000F3 is a water-cooled version of the air-cooled 3X2500F3.

The 3W5000F3 should be used where water cooling is preferred and for industrial applications or installations where reserve anode dissipation is desired.



GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated tungsten		
Voltage	7.5	volts
Current	51	amperes
Maximum allowable starting current	100	amperes
Amplification Factor (Average)	20	
Direct Interelectrode Capacitances (Average)		
Grid-Plate	21	uuf
Grid-Filament	36	uuf
Plate-Filament	1.2	uuf
Transconductance (I_b=830 ma, E_b=3000v)	20,000	umhos
Frequency for Maximum Ratings	30	mc

MECHANICAL

Base	see drawing	
Mounting	vertical, base down or up	
Maximum Over-All Dimensions:		
Length (Does not include filament connectors)	12.56	inches
Diameter	3.63	inches
Net Weight	4.8	pounds
Shipping Weight (Average)	15	pounds
Cooling	Water and forced air	

RADIO FREQUENCY POWER AMPLIFIER OR OSCILLATOR

(Frequencies below 30 Mc.)
Class-C FM or Telegraphy
(Key-down conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	6000	MAX. VOLTS
D-C PLATE CURRENT	2.5	MAX. AMPS
PLATE DISSIPATION	5000	MAX. WATTS
GRID DISSIPATION	150	MAX. WATTS

TYPICAL OPERATION
(Frequencies below 30 Mc., per tube)

D-C Plate Voltage	4000	5000	6000	volts
D-C Plate Current	2.5	2.5	2.08	amps
D-C Grid Voltage	—300	—450	—500	volts
D-C Grid Current	245	265	180	ma
Peak R-F Grid Input Voltage	580	750	765	volts
Driving Power (approx.)	142	197	136	watts
Grid Dissipation	68	78	46	watts
Plate Power Input	10,000	12,500	12,500	watts
Plate Dissipation	2500	2500	2500	watts
Plate Power Output	7500	10,000	10,000	watts

PLATE MODULATED RADIO FREQUENCY AMPLIFIER

(Frequencies below 30 Mc.)
Class-C Telephony
(Carrier conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	5000	MAX. VOLTS
D-C PLATE CURRENT	2.0	MAX. AMPS
PLATE DISSIPATION	3350	MAX. WATTS
GRID DISSIPATION	150	MAX. WATTS

TYPICAL OPERATION
(Frequencies below 30 Mc., per tube)

D C Plate Voltage	4000	4500	5000	volts
D-C Plate Current	1.67	1.55	1.45	amps
Total Bias Voltage	—450	—500	—550	volts
Fixed Bias Voltage	—230	—325	—410	volts
Grid Resistor	1500	1500	1400	ohms
D-C Grid Current	150	120	100	ma
Peak R-F Grid Input Voltage	680	720	760	volts
Driving Power (approx.)	102	86	76	watts
Grid Dissipation	35	26	21	watts
Plate Power Input	6670	6970	7250	watts
Plate Dissipation	1670	1670	1670	watts
Plate Power Output	5000	5300	5580	watts

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AUDIO FREQUENCY POWER AMPLIFIER AND MODULATOR

Class B (Sinusoidal wave, two tubes unless otherwise specified)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	6000 MAX. VOLTS
MAX-SIGNAL D-C PLATE CURRENT, PER TUBE	2.5 MAX. AMPS
PLATE DISSIPATION, PER TUBE	5000 MAX. WATTS

TYPICAL OPERATION (Sinusoidal wave, two tubes unless noted)

D-C Plate Voltage	4000	5000	6000	volts
D-C Grid Voltage[1]	—150	—190	—240	volts
Zero-Signal D-C Plate Current	0.6	0.5	0.4	amps
Max-Signal D-C Plate Current	4.0	3.2	3.0	amps
Effective Load, Plate to Plate	2200	3600	4650	ohms
Peak A-F Grid Input Voltage (per tube)*	340	360	390	volts
Max-Signal Peak Driving Power*	340	230	225	watts
Max-Signal Nominal Driving Power*	170	115	113	watts
Max-Signal Plate Output Power	11,000	11,000	13,000	watts

*Approximate values.

[1] Adjust to give listed zero-signal plate current.

TYPICAL OPERATION CLASS AB_2 (Two Tubes)

Modulator service for 4000 and 5000 volt operation, to modulate one or two tubes, as shown under "Plate Modulated Radio Frequency Amplifier" (Page 1)

D-C Plate Voltage	4000	5000	4000	5000	volts
D-C Grid Voltage (approx.)*	—155	—200	—145	—190	volts
Zero-Signal D-C Plate Current	0.4	0.4	0.6	0.5	amps
Max-Signal D-C Plate Current	1.35	1.13	2.70	2.26	amps
Effective Load, Plate to Plate	6600	10,000	3300	5000	ohms
Peak A-F Grid Input Voltage (per tube)	240	275	285	310	volts
Max-Signal Peak Driving Power	42	40	134	118	watts
Max-Signal Nominal Driving Power (approx.)	21	20	67	59	watts
Max-Signal Plate Power Output	3700	4000	7400	8000	watts
Will Modulate one Tube R-F Final Input of	6670	7250			watts
Will Modulate two tubes R-F Final Input of			13,340	14,500	watts

*Adjust to give stated zero-signal plate current.

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER "TYPICAL OPERATION," POSSIBLY EXCEEDING THE MAXIMUM RATINGS GIVEN FOR CW SERVICE, WRITE EITEL-McCULLOUGH, INC., FOR INFORMATON AND RECOMMENDATIONS

APPLICATION

▶ **Cooling**—The water-cooled anode requires one gallon of cooling water per minute for the rated plate dissipation of 5 kilowatts. The outlet water temperature must not exceed a maximum of 70° C under any conditions. The inlet water pressure must not exceed a maximum of 60 pounds per square inch. The pressure drop across the anode is negligible compared to the drop in the associated piping.

The grid-terminal contact surface and adjacent glass must be cooled by forced air. The quantity, velocity and direction must be adjusted to limit the maximum seal temperature to 150° C.

The filament stem structure also requires forced-air cooling. A minimum of 6 cubic feet per minute must be directed into the space between the inner and outer filament contacting surfaces.

Air and water flow must be started before filament power is applied and maintained for at least five minutes after the filament power has been removed.

Filament Voltage—The filament voltage, as measured directly at the tube, should be 7.5 volts with maximum allowable variations due to line fluctuation of from 7.12 to 7.87 volts.

Bias Voltage—There is little advantage in using bias voltages in excess of those given under "Typical Operation," except in certain very specialized applications. Where bias is obtained from a grid resistor, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation.

Plate Voltage—The plate supply voltage for the 3W5000F3 should not exceed 6000 volts. In most cases there is little advantage in using plate-supply voltages higher than those given under "Typical Operation" for the power output desired.

In Class-C FM or Telegraphy service, a 0.1 henry choke, shunted by a spark gap, should be series connected between the plates of the amplifier tubes and the high voltage plate supply capacitor to offer protection from transients and surges. In plate modulated service, where a plate modulation transformer is used, the protective choke is not normally required.

Grid Dissipation—The power dissipated by the grid of the 3W5000F3 must never exceed 150 watts. Grid dissipation may be calculated from the following expression

$$P_g = e_{cmp} I_c$$

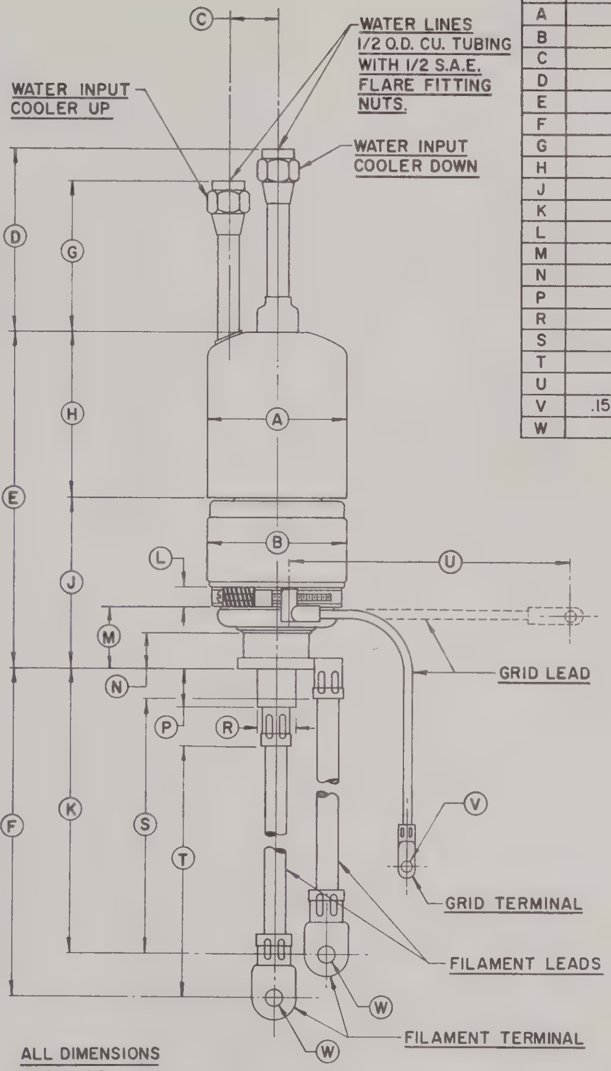
where P_g = Grid dissipation,
e_{cmp} = Peak positive grid voltage, and
I_c = D-C grid current

e_{cmp} may be measured by means of a suitable peak voltmeter connected between filament and grid. Any suitable peak v.t.v.m. circuit may be used.

In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading.

▶ Indicates change from sheet dated 3-1-51.

▶



ALL DIMENSIONS IN INCHES

DIMENSION DATA			
REF.	NOM.	MIN.	MAX.
A		3.234	3.266
B			3.625
C		1.062	1.187
D		4.000	4.500
E		7.562	8.062
F		8.937	9.437
G		3.250	3.750
H		3.625	3.875
J		3.937	4.187
K		7.937	8.437
L		.375	.437
M		1.437	1.562
N		.812	.937
P		.812	.937
R		.859	.890
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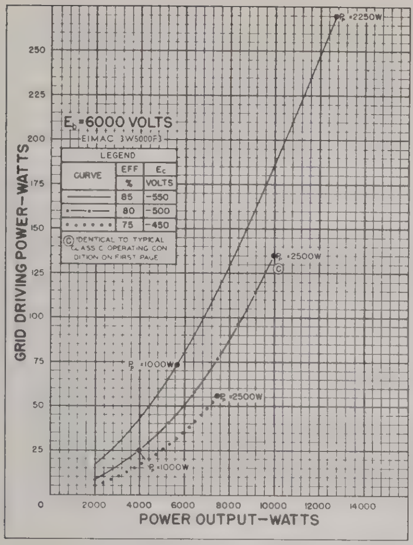
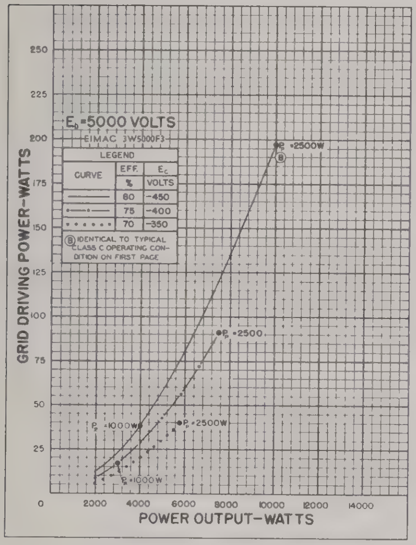
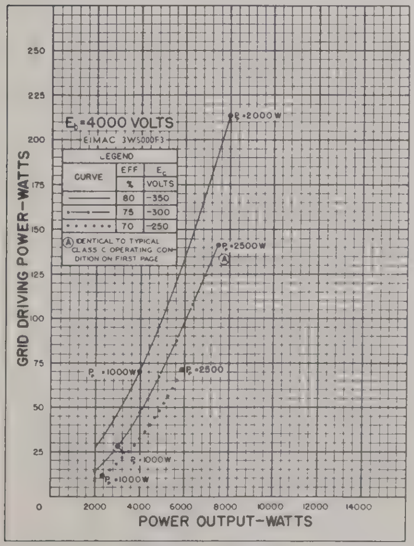
T		7.000	7.500
U		6.375	6.625
V	.156		
W		.385	.395



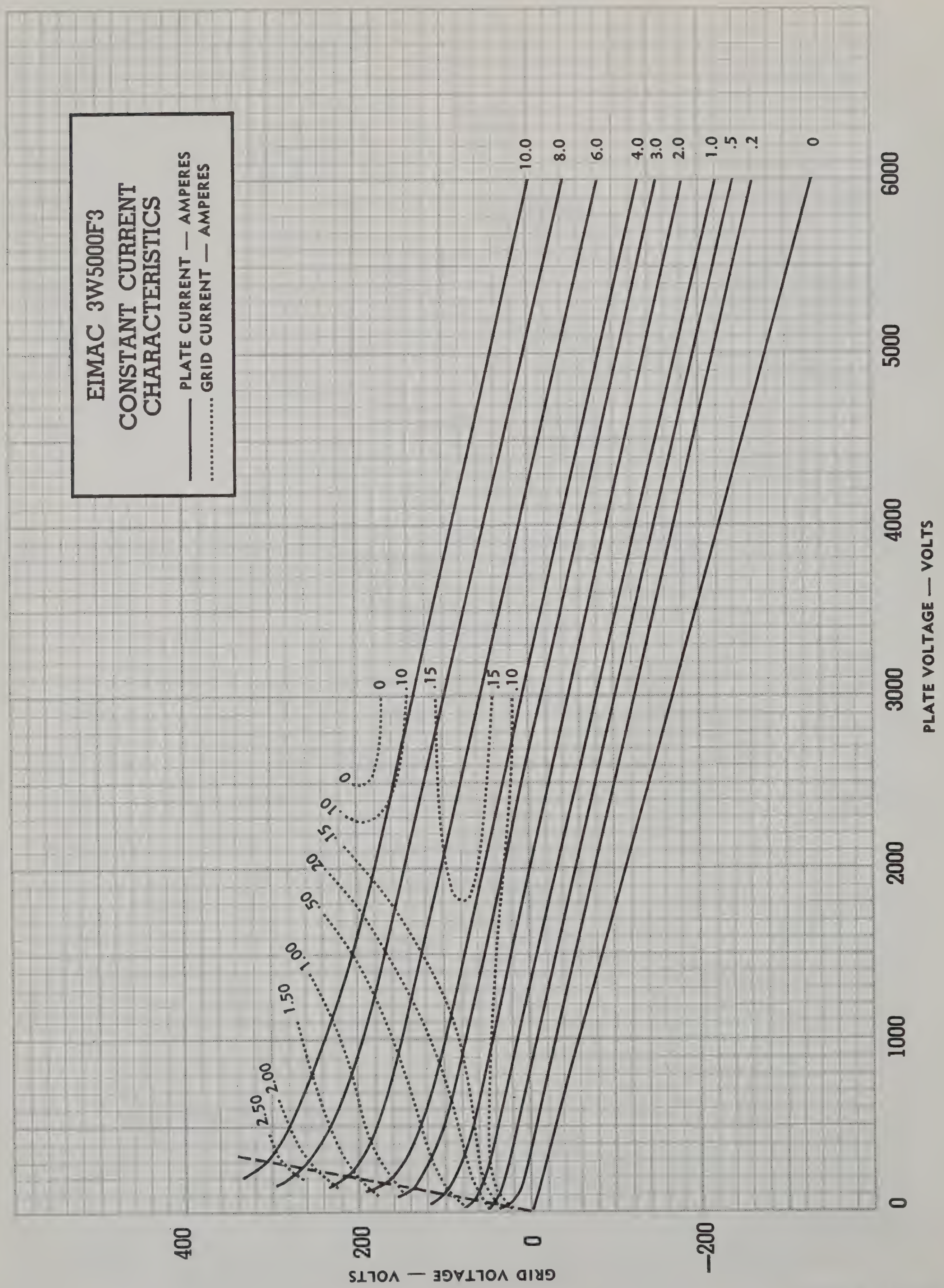




DRIVING POWER vs. POWER OUTPUT

The three charts on this page show the relationship of plate efficiency, power output and approximate grid driving power at plate voltages of 4000, 5000 and 6000 volts. These charts show combined grid and bias losses only. The driving-power and power-output figures do not include circuit losses. The plate dissipation in watts is indicated by Pp. Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 4000, 5000 and 6000 volts respectively.

▶ Indicates change from sheet dated 3-1-51.



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EITEL-McCULLOUGH, INC.
SAN CARLOS · CALIFORNIA

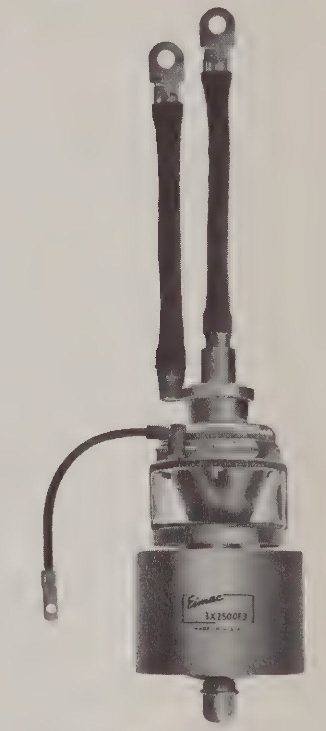
3X2500F3

MEDIUM-MU TRIODE

The Eimac 3X2500F3 is a medium-mu, forced-air cooled, external-anode power triode intended for amplifier, oscillator, or modulator service. It has a maximum plate-dissipation rating of 2500 watts and is capable of high output at relatively low plate voltages. A single 3X2500F3 will deliver a radio-frequency plate power output of 7500 watts at a plate voltage of 4000 volts.

The tube is equipped with flexible filament and grid leads which simplify socketing and equipment design for industrial and communication frequencies below 30 megacycles.

The approved Federal Communications Commission rating for the 3X2500F3 is 5000 watts of carrier power when used as a plate-modulated amplifier and 1250 watts of carrier power when used as a grid-modulated or linear amplifier.



GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten	Min.	Nom.	Max.	
Voltage		7.5		volts
Current	49		54	amperes
Amplification Factor	19		26	
Direct Interelectrode Capacitances:				
Grid-Plate	16.8		23.2	uuf
Grid-Filament	29.2		40.2	uuf
Plate-Filament	0.6		1.2	uuf
Transconductance ($I_b = 830$ ma., $E_b = 3000$ v.)		20,000		umhos
Highest Frequency for Maximum Ratings			30	mc

MECHANICAL

Base	See outline drawing
Mounting	Vertical, base down or up
Maximum Anode Cooler Core and Seal Temperatures	150° C
Cooling	Forced air
Maximum Over-All Dimensions:	
Length (Does not include filament connectors)	8.6 inches
Diameter	4.16 inches
Length of Filament Connectors	7 inches
Net Weight	7.5 pounds
Shipping Weight (Approximate)	17 pounds

RADIO-FREQUENCY POWER AMPLIFIER OR OSCILLATOR

Conventional Neutralized Amplifier,
Class-C FM or Telegraphy (Key-Down Conditions)

MAXIMUM RATINGS	
D-C PLATE VOLTAGE	6000 MAX. VOLTS
D-C PLATE CURRENT	2.5 MAX. AMPS
PLATE DISSIPATION	2500 MAX. WATTS
GRID DISSIPATION	150 MAX. WATTS

TYPICAL OPERATION (Frequencies below 30 Mc)				
D-C Plate Voltage	4000	5000	6000	volts
D-C Plate Current	2.5	2.5	2.08	amps
D-C Grid Voltage	—300	—450	—500	volts
D-C Grid Current	245	265	180	ma
Peak R-F Grid Input Voltage*	580	750	765	volts
Driving Power*	142	197	136	watts
Grid Dissipation*	68	78	46	watts
Plate Input Power	10,000	12,500	12,500	watts
Plate Dissipation	2500	2500	2500	watts
Plate Output Power	7500	10,000	10,000	watts

*Approximate values.

PLATE-MODULATED RADIO-FREQUENCY AMPLIFIER

Conventional Neutralized Amplifier,
Class-C Telephony (Carrier Conditions)

MAXIMUM RATINGS	
D-C PLATE VOLTAGE	5000 MAX. VOLTS
D-C PLATE CURRENT	2.0 MAX. AMPS
PLATE DISSIPATION	1670 MAX. WATTS
GRID DISSIPATION	150 MAX. WATTS

TYPICAL OPERATION (Frequencies below 30 Mc)				
D-C Plate Voltage	4000	4500	5000	volts
D-C Plate Current	1.67	1.47	1.25	amps
D-C Grid Voltage	—450	—500	—550	volts
D-C Grid Current*	180	140	150	ma
Peak R-F Grid Input Voltage*	685	715	760	volts
Driving Power*	125	100	115	watts
Grid Dissipation*	43	30	32	watts
Plate Input Power	6670	6615	6250	watts
Plate Dissipation	1670	1315	950	watts
Plate Output Power	5000	5300	5300	watts

*Approximate values.

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AUDIO-FREQUENCY POWER AMPLIFIER OR MODULATOR

Class-AB or B

MAXIMUM RATINGS

D-C PLATE VOLTAGE - - - -	6000 MAX. VOLTS
D-C PLATE CURRENT - - - -	2.5 MAX. AMPS
PLATE DISSIPATION - - - -	2500 MAX. WATTS
GRID DISSIPATION - - - -	150 MAX. WATTS

TYPICAL OPERATION (Sinusoidal wave, two tubes unless noted)

D-C Plate Voltage - - - - - - -	4000	5000	6000 volts
D-C Grid Voltage[1] - - - - -	—150	—190	—240 volts
Zero-Signal D-C Plate Current - - -	0.6	0.5	0.4 amps
Max-Signal D-C Plate Current - - -	4.0	3.2	3.0 amps
Effective Load, Plate to Plate - - -	2200	3600	4650 ohms
Peak A-F Grid Input Voltage (per tube)* -	340	360	390 volts
Max-Signal Peak Driving Power* - - -	340	230	225 watts
Max-Signal Nominal Driving Power* - -	170	115	113 watts
Max-Signal Plate Output Power - -	11,000	11,000	13,000 watts

*Approximate values.

[1] Adjust to give listed zero-signal plate current.

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER "TYPICAL OPERATION", POSSIBLY EXCEEDING THE MAXIMUM RATINGS GIVEN FOR CW SERVICE, WRITE EITEL-McCULLOUGH, INC., FOR INFORMATION AND RECOMMENDATIONS

APPLICATION

Cooling—Forced-air cooling must be provided to hold the glass-to-metal seals and the anode cooler core below the maximum rated temperature of 150° C. Although the air requirements stated below are sufficient to maintain rated tube temperatures under many conditions, air in excess of the amounts shown will usually result in longer tube life. At ambient temperatures higher than 40° C and at high altitudes additional air flow must be provided. In all cases, tube temperatures are the criteria which govern air requirements. Surface temperatures may be measured conveniently with the aid of temperature-sensitive paints.

The minimum air-flow requirement for the anode cooler at the maximum rated plate dissipation of 2500 watts and with an inlet-air temperature of 20° C is 125 CFM. At sea level the pressure drop across the cooler for this air flow is 2.3 inches.

Under the same conditions, a minimum air-flow rate of 6 CFM directed into the filament-stem structure between the inner and outer filament terminals is required to maintain the base seals at 150° C.

Simultaneous removal of all power and air (as in the case of a power failure) will not ordinarily injure the tube, but it is not recommended as a standard operating practice.

Filament Voltage—The filament voltage, as measured directly at the tube, should be 7.5 volts with maximum allowable variations due to line fluctuation of from 7.12 to 7.87 volts.

Bias Voltage—There is little advantage in using bias voltages in excess of those given under "Typical Operation", except in certain very specialized applications. Where bias is obtained from a grid resistor, suitable protective means must be provided to prevent excessive plate dissipation in the event of loss of excitation.

Plate Voltage—The plate-supply voltage for the 3X2500F3 should not exceed 6000 volts. In most cases there is little advantage in using plate-supply voltages higher than those given under "Typical Operation" for the power output desired.

In Class-C FM or Telegraphy service, a 0.1—henry choke, shunted by a spark gap, should be series connected between the plates of the amplifier tubes and the high-voltage plate-supply capacitor to offer protection from transients and surges. In plate-modulated service, where a plate-modulation transformer is used, the protective choke is not normally required.

Grid Dissipation—The power dissipated by the grid of the 3X2500F3 must never exceed 150 watts. Grid dissipation may be calculated from the following expression:

$$P_g = e_{cmp} I_c$$

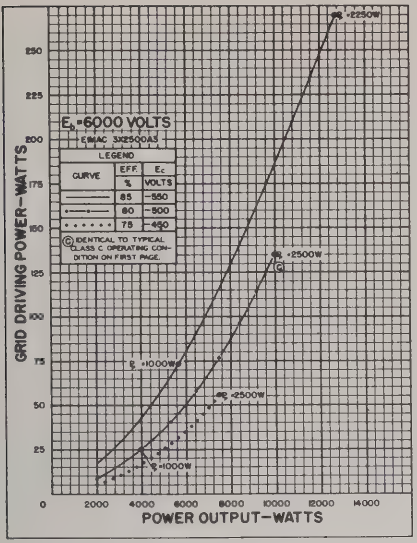
where: P_g = Grid dissipation,

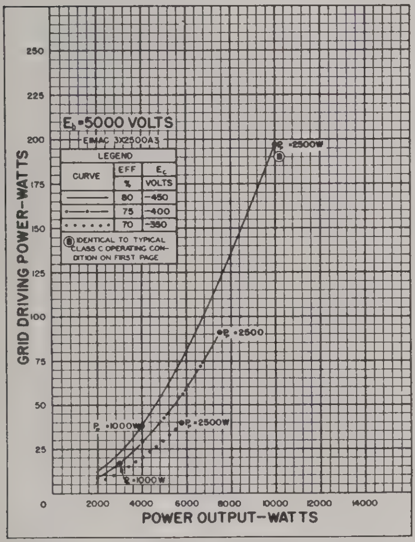
e_{cmp} = Peak positive grid voltage, and

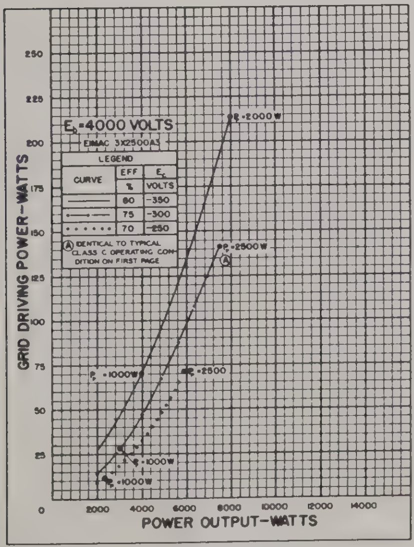
I_c = D-C grid current.

e_{cmp} may be measured by means of a suitable peak voltmeter connected between filament and grid. Any suitable peak v.t.v.m. circuit may be used.

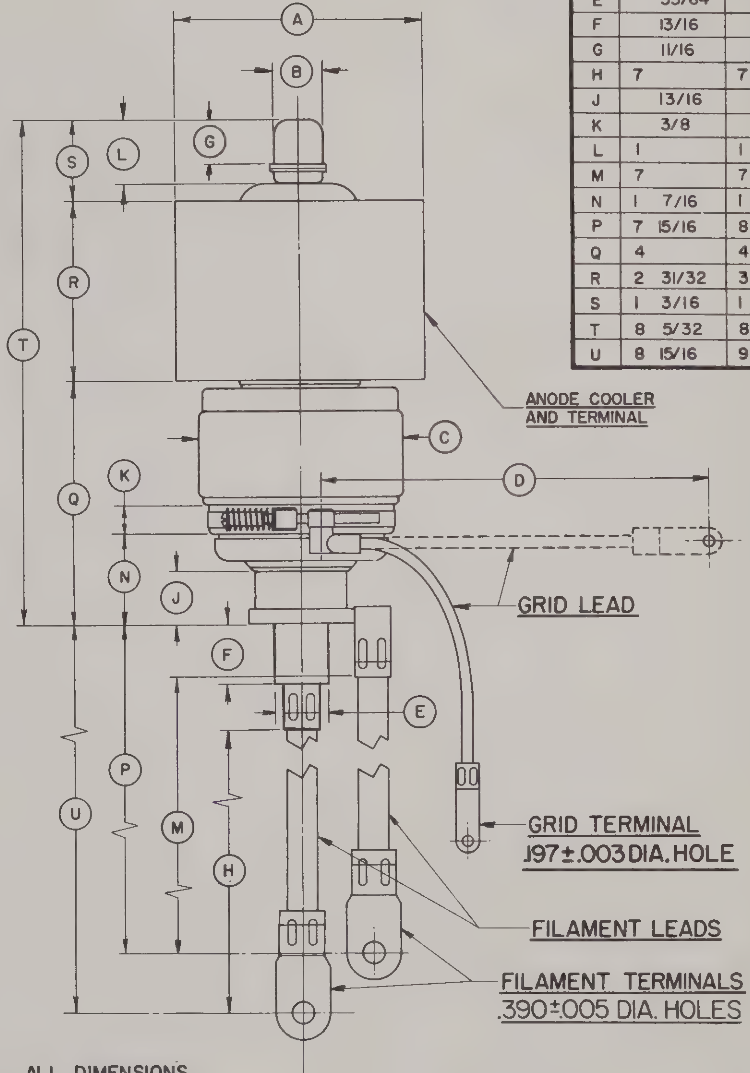
In equipment in which the plate loading varies widely, such as oscillators used for radio-frequency heating, care should be taken to make certain that the grid dissipation does not exceed the maximum rating under any condition of loading. With lightly loaded conditions the grid driving power should be reduced so that the grid current does not exceed one-tenth of the plate current.







DIMENSION DATA		
REF.	MIN	MAX
A	4 3/32	4 5/32
B	25/32	27/32
C		3 5/8
D	6 3/8	6 5/8
E	55/64	57/64
F	13/16	15/16
G	11/16	13/16
H	7	7 1/2
J	13/16	15/16
K	3/8	7/16
L	1	1 1/8
M	7	7 1/2
N	1 7/16	1 9/16
P	7 15/16	8 7/16
Q	4	4 1/8
R	2 31/32	3 1/32
S	1 3/16	1 7/16
T	8 5/32	8 19/32
U	8 15/16	9 7/16

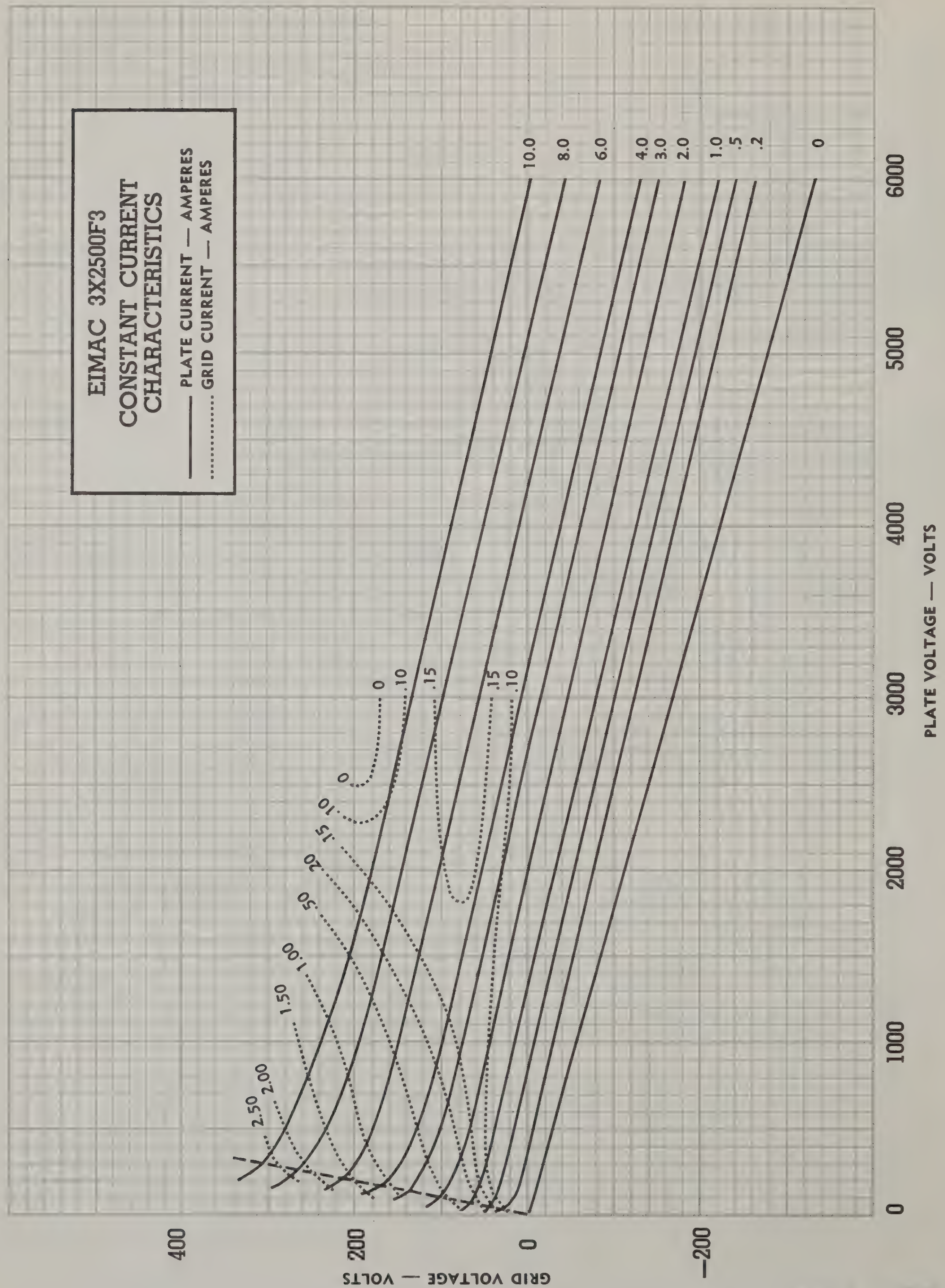


ALL DIMENSIONS IN INCHES

DRIVING POWER vs. POWER OUTPUT

The three charts on this page show the relationship of plate efficiency, power output and approximate grid driving power at plate voltages of 4000, 5000 and 6000 volts. These charts show combined grid and bias losses only. The driving-power and power-output figures do not include circuit losses. The plate dissipation in watts is indicated by Pp. Points A, B, and C are identical to the typical Class C operating conditions shown on the first page under 4000, 5000 and 6000 volts respectively.

▶ **Indicates change from sheet dated 1-27-58**


EIMAC 3X2500F3
CONSTANT CURRENT CHARACTERISTICS
PLATE CURRENT — AMPERES
GRID CURRENT — AMPERES
10.0
8.0
6.0
4.0
3.0
2.0
1.0
.5
.2
0
2.50
2.00
1.50
1.00
.50
.20
.15
.10
0
0
.10
.15
.15
.10
0
1000
2000
3000
4000
5000
6000
PLATE VOLTAGE — VOLTS
400
200
0
−200
GRID VOLTAGE — VOLTS

diodes · rectifiers ▸

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IMPORTANT EIMAC "EXTRAS"

Application Engineering. The Eimac Application Engineering Department is available at all times for consultation. New tube operating techniques are continually being explored, tested and proved by Eimac application engineers, whose combined knowledge and experience are made available to you. Additional contributions by this Eimac department are its Application Bulletins, an expanding service which you get without obligation.

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Eimac®

EITEL-McCULLOUGH, INC.
SAN CARLOS · CALIFORNIA

2-01C
INSTRUMENT DIODE

The Eimac 2-01C is a small, closely-spaced, low-capacitance, high-vacuum diode designed for use through ultra-high frequencies. In measurement work, it is well suited to mounting in a probe and will maintain accuracy in the order of ± 1 decibel up to 700 megacycles. It is useful as an indicator at frequencies as high as 3000 megacycles.

The 2-01C has a maximum d-c current rating of 1.0 milliampere and a maximum peak inverse voltage rating of 1000 volts. Cooling is by convection and radiation.

Actual Size

GENERAL CHARACTERISTICS

▶ ELECTRICAL

Cathode—Oxide-Coated, Unipotential

	Min.	Nom.	Max.	
Heating Time	30	60		seconds
Heater Voltage		5.0		volts
Heater Current	0.31		0.39	amperes
Direct Interelectrode Capacitance			0.7	uuf
Zero Signal Voltage (110 Megohm Load)	0.6		1.4	volts
Resonant Frequency		2800		mc
Plate Resistance (E_b=12 volts)		8000	24,000	ohms

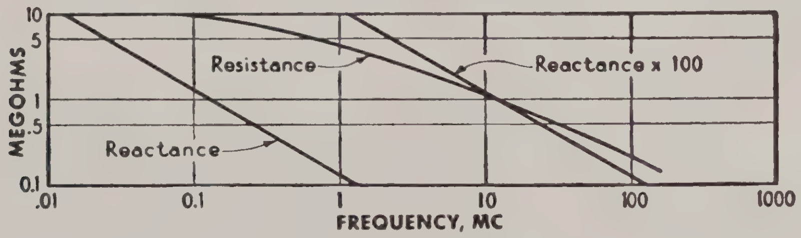
▶ MAXIMUM RATINGS

PEAK INVERSE ANODE VOLTAGE	1000 MAX.	VOLTS
D-C PLATE CURRENT	1.0 MAX.	MA
PLATE DISSIPATION	0.1 MAX.	WATT
SEAL TEMPERATURE	175°C MAX.	

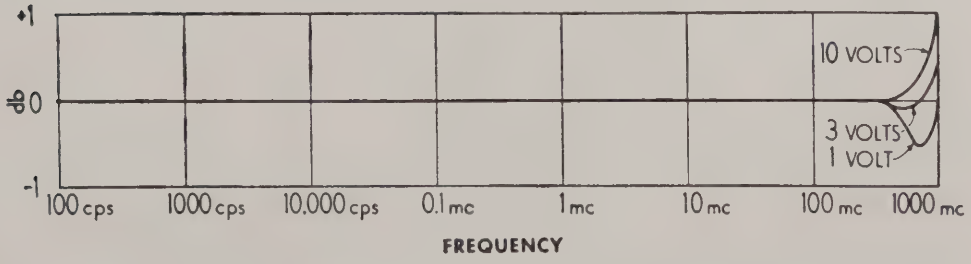
MECHANICAL

Length	1.813 inches	Net Weight	0.2 ounce
Diameter	0.563 inches	Shipping Weight (Approx.)	1.0 pound

INPUT CHARACTERISTICS



RESPONSE



Input Impedance and Frequency Response of an Eimac 2-01C operating in a Hewlett-Packard Model 410B Vacuum Tube Voltmeter. Reproduced from Hewlett-Packard Catalog No. 21-A, 1952.

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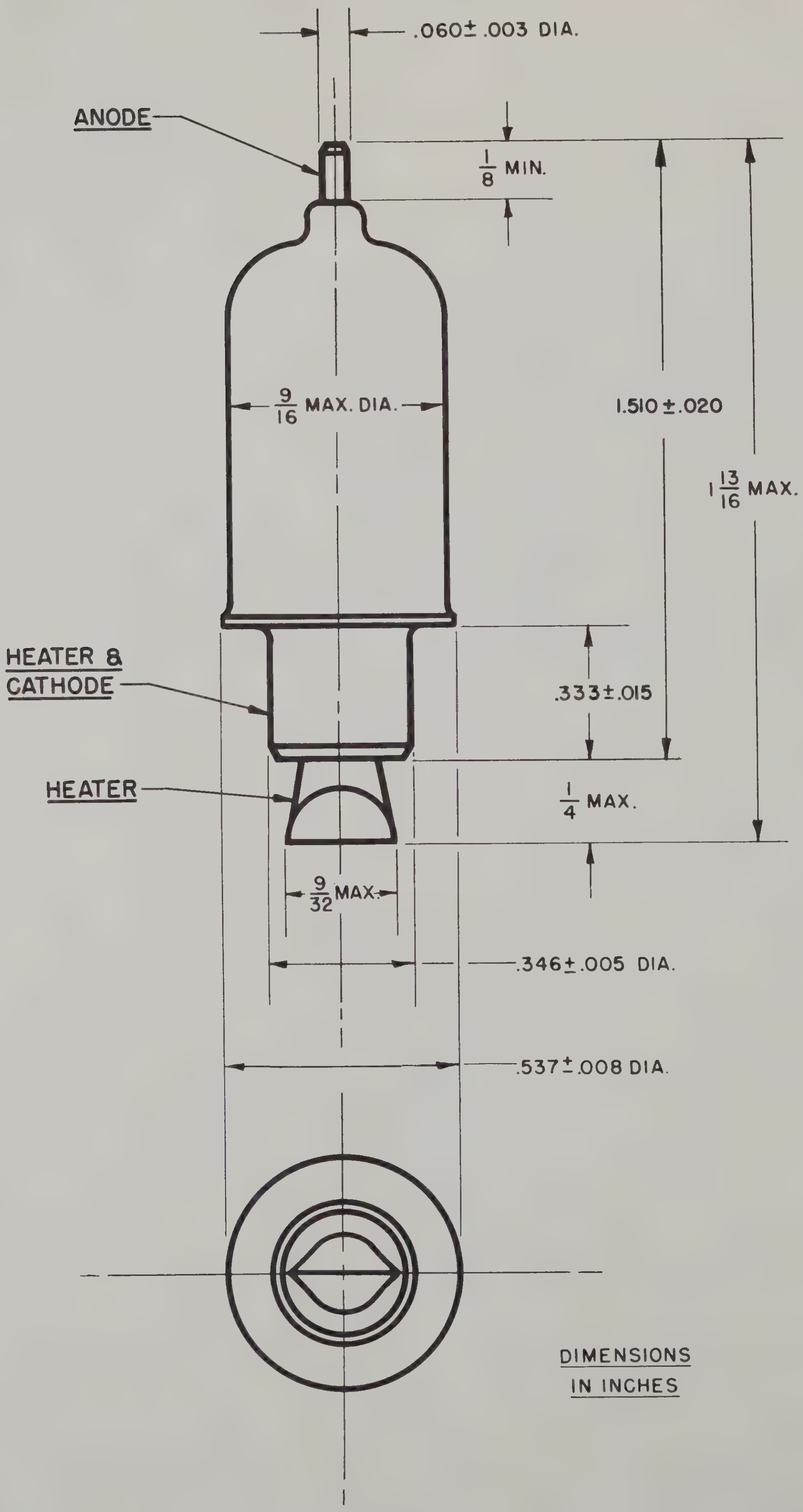

DIMENSIONS IN INCHES

▶ Indicates change from sheet dated 11-14-58

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

2-25A
HIGH-VACUUM RECTIFIER

The Eimac 2-25A diode is a high-vacuum rectifier intended for use in rectifier units, voltage multipliers, or in special applications, whenever conditions of extreme ambient temperatures, high operating frequency, high peak inverse voltages, or the production of high-frequency transients would prevent the use of gas-filled rectifier tubes.

The 2-25A has a maximum d-c current rating of 50 milliamperes and a maximum peak inverse voltage rating of 25,000 volts. Cooling is by convection and radiation.

A single 2-25A will deliver 40 milliamperes at 10,000 volts to a capacitor-input filter with 8800 volts single-phase supply. Four 2-25A's in a bridge circuit will deliver 100 milliamperes at 15,600 volts to a choke-input filter with 17,600 volts single-phase supply.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten

Voltage	6.3 volts
Current	3.0 amperes

MECHANICAL

Base	Small 4-pin
Basing	Refer to outline drawing
Socket	Refer to discussion under "Application"
Mounting Position	Vertical, base down or up
Cooling	Convection and radiation
Maximum Temperature of Plate Seal	225°C
Recommended Heat Dissipating Plate Connector	Eimac HR-1
Maximum Overall Dimensions:	
Length	4.38 inches
Diameter	1.44 inches
Net Weight	1.2 ounces
Shipping Weight (approx.)	1.0 pound

MAXIMUM RATINGS (Per tube)

PEAK INVERSE PLATE VOLTAGE	25,000 MAX. VOLTS
PLATE DISSIPATION	15 MAX. WATTS
D-C PLATE CURRENT[1]	50 MAX. MA
PEAK PLATE CURRENT	1.0 MAX. AMPERE

[1] Averaged over one cycle for each tube. Applies only when the rectifier is coupled to the load by a choke-input filter incorporating the "critical" value (or larger) of input inductance. For maximum d-c current ratings under this and other load conditions see discussion under "Application".

APPLICATION

MECHANICAL

Mounting—The 2-25A must be mounted vertically with the base either down or up. The lead to the plate terminal of the tube should be flexible.

The small 4-pin base fits an E. F. Johnson Co. No 122-224, a National Co. No. XC-4 or CIR-4, or an equivalent socket. In some circuits, particularly those of the voltage multipliers illustrated in Fig. 2, it may be necessary to mount the socket on stand-off insulators, or on a sheet of insulating material, to provide adequate insulation to ground.

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Cooling—The 2-25A is cooled by convection and radiation. Clearance should be provided around the glass envelope adequate for the free circulation of air. An Eimac HR-1 Heat Dissipating Connector or equivalent is required on the plate terminal.

The maximum temperature at the plate seal must not exceed 225°C. A convenient accessory for measuring this temperature is "Tempilaq", a temperature-sensitive lacquer available from the Tempil Corporation, 132 W. 22nd St., New York 11, N. Y.

ELECTRICAL

Filament Operation—For maximum tube life, the filament voltage, as measured at the base pins, should be the rated value of 6.3 volts. Variations must be kept within the range from 6.0 to 6.6 volts. In applications which require the diode to deliver high peak currents, it is important to maintain the filament voltage at the rated value.

> CAUTION SHOULD BE OBSERVED WHEN MEASURING RECTIFIER FILAMENT VOLTAGE. THE FILAMENT CIRCUIT MAY BE AT HIGH POTENTIAL.

The thoriated-tungsten filament of the 2-25A reaches operating temperature in a fraction of a second after application of voltage. Plate voltage may be applied simultaneously with filament voltage.

Plate Operation—With low room illumination, the plate of the 2-25A begins to show color as the maximum plate dissipation rating of 15 watts is approached. The maximum peak inverse voltage rating of 25,000 volts should not be exceeded at any time.

Performance—The accompanying table shows some maximum performance capabilities of the 2-25A when used as a power-supply rectifier.

2-25A MAXIMUM-PERFORMANCE CAPABILITIES

		Capacitor-Input Filter		Choke-Input Filter	
Circuit Type	A-C Input Voltage (volts rms)	D-C Output Voltage (volts)	D-C Output Current (ma)	D-C Output Voltage (volts)	D-C Output Current (ma)
Single-Phase, Half-Wave	8800	10,000	40	--------	--------
Single-Phase, Full-Wave	8800[1]	10,000	80	7900	100
Single-Phase, Bridge	17,600	20,000	80	15,800	100

[1] One-half the transformer secondary voltage.

Maximum D-C Current Ratings —Plate dissipation rather than peak current usually limits the d-c current which the 2-25A is capable of delivering to the load. Because the plate dissipation associated with a given d-c current depends upon the amount of ripple and its wave-shape, circuit conditions will determine the maximum d-c current rating of the tube.

Choke-Input Filter—The maximum d-c current rating of the 2-25A is 50 milliamperes when the load incorporates a choke-input filter with the "critical" value (or larger) of input inductance (L_1 in Fig. 1):

$$L_o = \frac{R_{eff}}{18.8f} \quad \text{for full-wave single-phase rectifiers,}$$

$$L_o = \frac{R_{eff}}{75f} \quad \text{for half-wave three-phase rectifiers,}$$

$$L_o = \frac{R_{eff}}{660f} \quad \text{for full-wave three-phase rectifiers,}$$

where: L_o = "critical" value of input inductance (henries),
f = supply-line frequency (cycles per second),

$$R_{eff} = \frac{\text{Load voltage (volts)}}{\text{Load current (amps)}}.$$

Choke-input filters are not normally used with single-phase half-wave rectifiers.

Capacitor-Input Filter—The 2-25A is particularly suitable for power-supply applications demanding high voltage at low current. Under these conditions capacitor-input filter circuits become desirable. The maximum d-c current rating of the 2-25A when no input choke is incorporated in the filter depends upon the total series resistance of the capacitor-charging circuit relative to the effective load resistance seen by each tube. The circuit diagrams and tabulation in Fig. 2 are so arranged and labeled that this required series resistance may be found for a wide range of load conditions. This may be done by determining the value of the following quantities:

E_c is the filter-input d-c voltage. While this is usually the entire load voltage, in the case of voltage multipliers it is the load voltage divided by the multiplication factor.

I_p is the d-c current per tube. This is the entire load current only in the case of the simple half-wave rectifier or half- or full-wave multiplier. In the case of full-wave center-tapped or bridge rectifiers, I_p is half the load current.

R_c is the total charging-circuit resistance. A certain minimum value of charging-circuit resistance is necessary to limit the peak value of current to which the tubes will be subjected under given load conditions. This required minimum depends upon the d-c current per tube (I_p), and has been tabulated in Fig. 2 as a percentage of the effective load resistance per tube (E_c/I_p). The total charging-circuit resistance involves the internal resistance of the rectifier tube, R_p, the added series resistor, R_s, and the equivalent internal resistance of the a-c voltage supply, R_i.

R_p is the plate resistance of the 2-25A, which may be taken as 1200 ohms.

R_i is the equivalent internal resistance of the supply. This may be taken as the regulation of the high-voltage supply expressed as a decimal multiplied by the load resistance used in measuring this regulation.

R_s is the series resistor which must be inserted in the charging circuit to bring the total charging-circuit resistance (R_c) up to the required minimum. Its value may be found from the formula associated with each of the circuits of Fig. 2. This resistor must be inserted in such a position in the circuit that it protects all tubes.

Tubes may be operated in parallel to increase the output capability in a given circuit. When two tubes are placed in parallel at each place where one is shown in the circuits of Fig. 2, the plate resistance (R_p) will be half as great and the maximum allowable load current twice as great as indicated.

Peak Inverse Voltage —The peak inverse voltage rating of the 2-25A is 25,000 volts. In single-phase power-supply rectifier circuits the peak inverse voltage to be used in design is the peak a-c supply voltage (1.41 times E_{rms} in Fig. 2) in the case of bridge circuits, and twice this value in the case of half- and full-wave rectifiers and voltage multipliers. Peak inverse voltage in three-phase operation depends upon the circuit employed, and will be found listed in the handbooks.

Special Applications—The ratings given for capacitor-input filter circuits assume values of input capacitance large enough to hold the ripple to a low value. In special applications where a larger percent ripple is tolerable, and filter capacitance is low, the 2-25A is capable of larger d-c output currents.

As a unidirectional conductor in d-c circuits where the current is continuous and the percent ripple is moderate, the maximum current rating of the 2-25A is 90 milliamperes.

The plate characteristic curve for the 2-25A serves as a guide to special applications. The maximum plate dissipation rating of 15 watts, the maximum peak inverse voltage rating of 25,000 volts, and the maximum peak plate current of 1.0 ampere must not be exceeded.

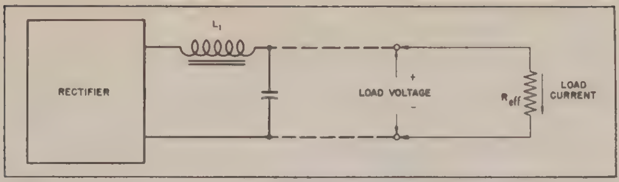
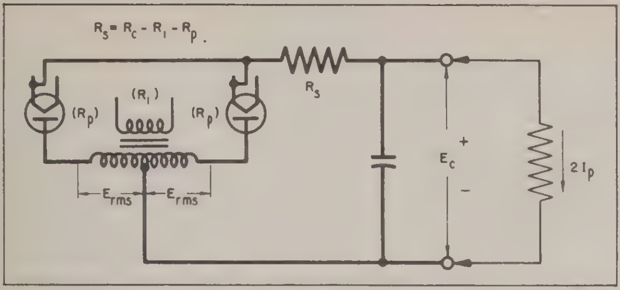
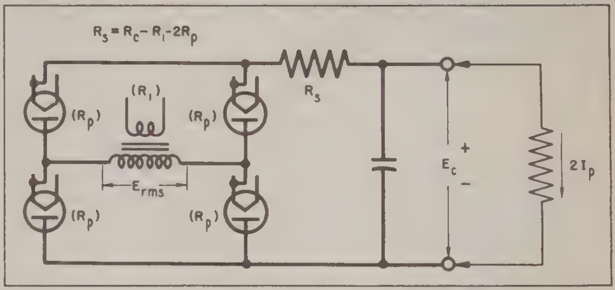


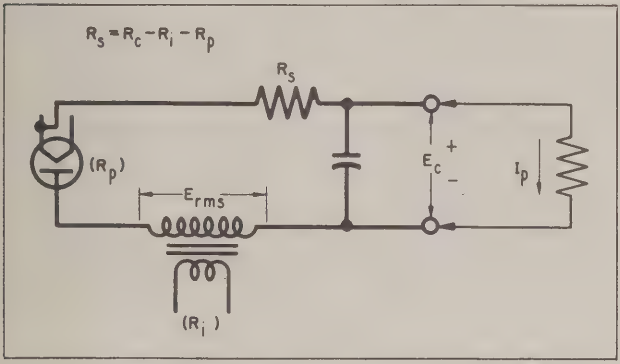
Fig. 1. Rectifier with Choke-Input Filter



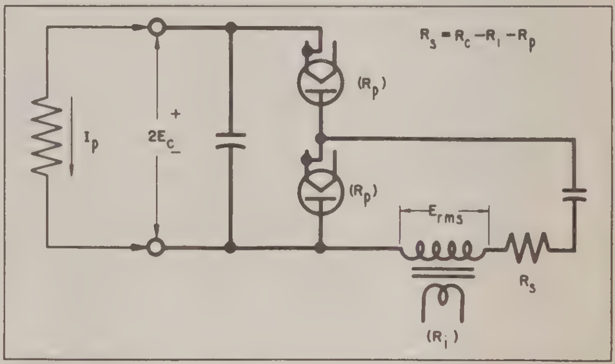
a. Full-Wave Center-Tapped Rectifier



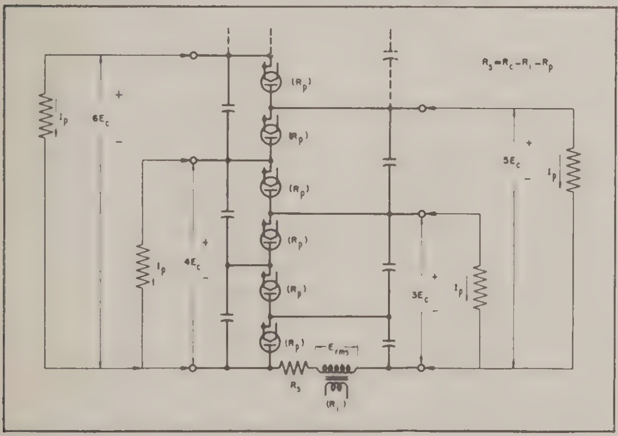
b. Full-Wave Bridge Rectifier



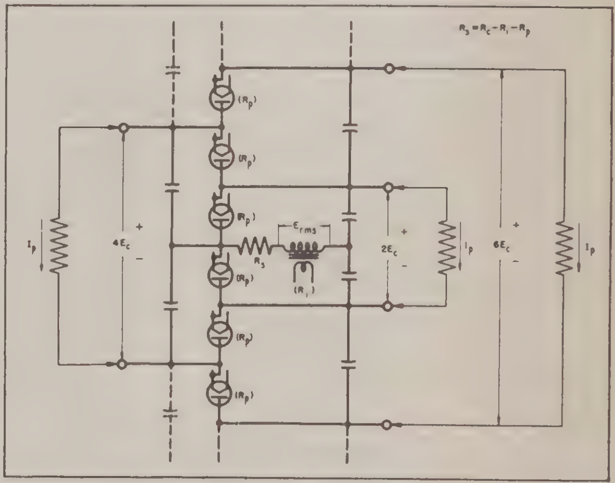
c. Half-Wave Rectifier



d. Half-Wave Voltage Doubler



e. Half-Wave Voltage Multiplier (with common ground when R_s is inserted on the "high" side of E_{rms})



f. Full-Wave Voltage Multiplier

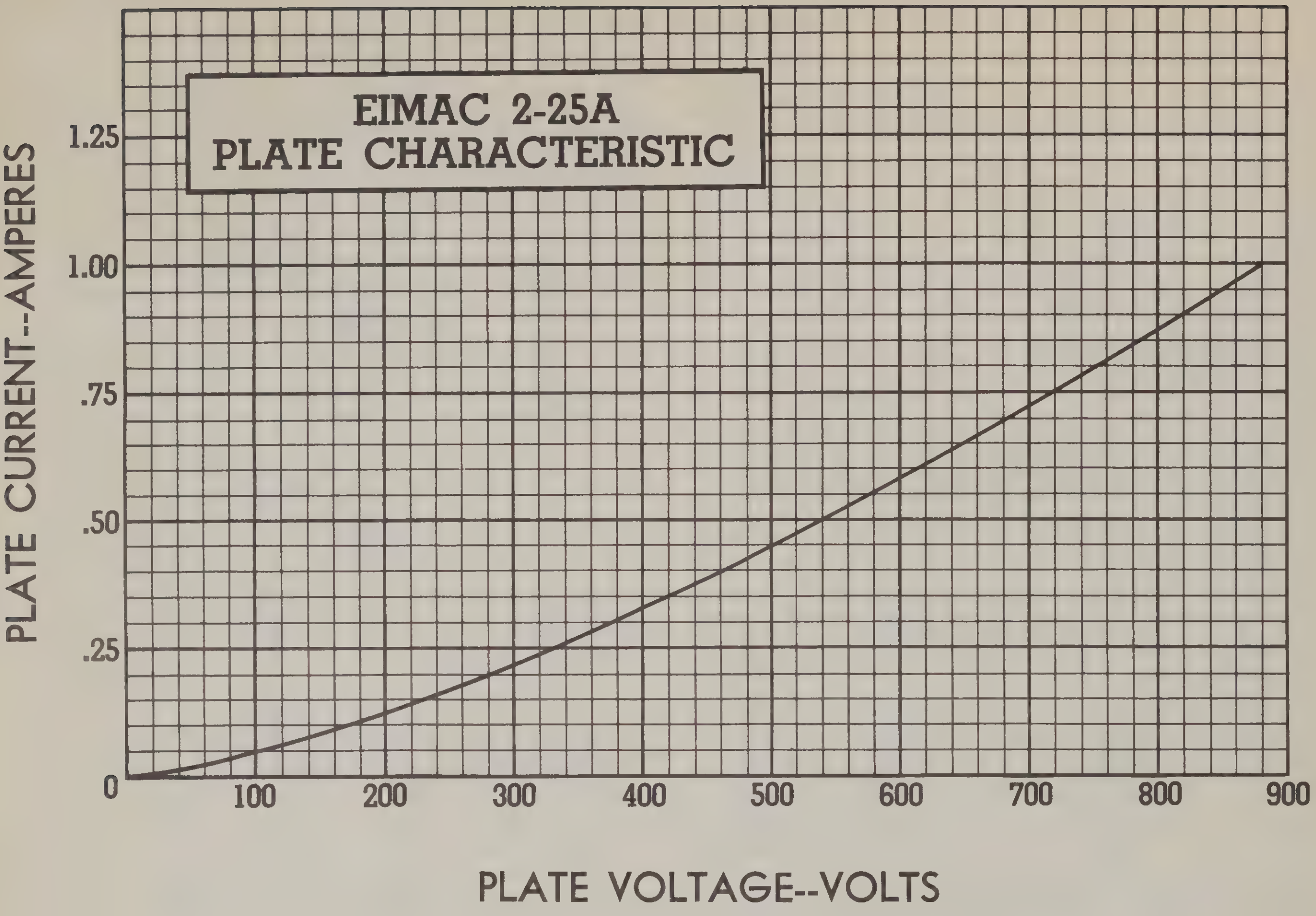
Eimac 2-25A Maximum D-C Current Ratings for R-C Filter Applications

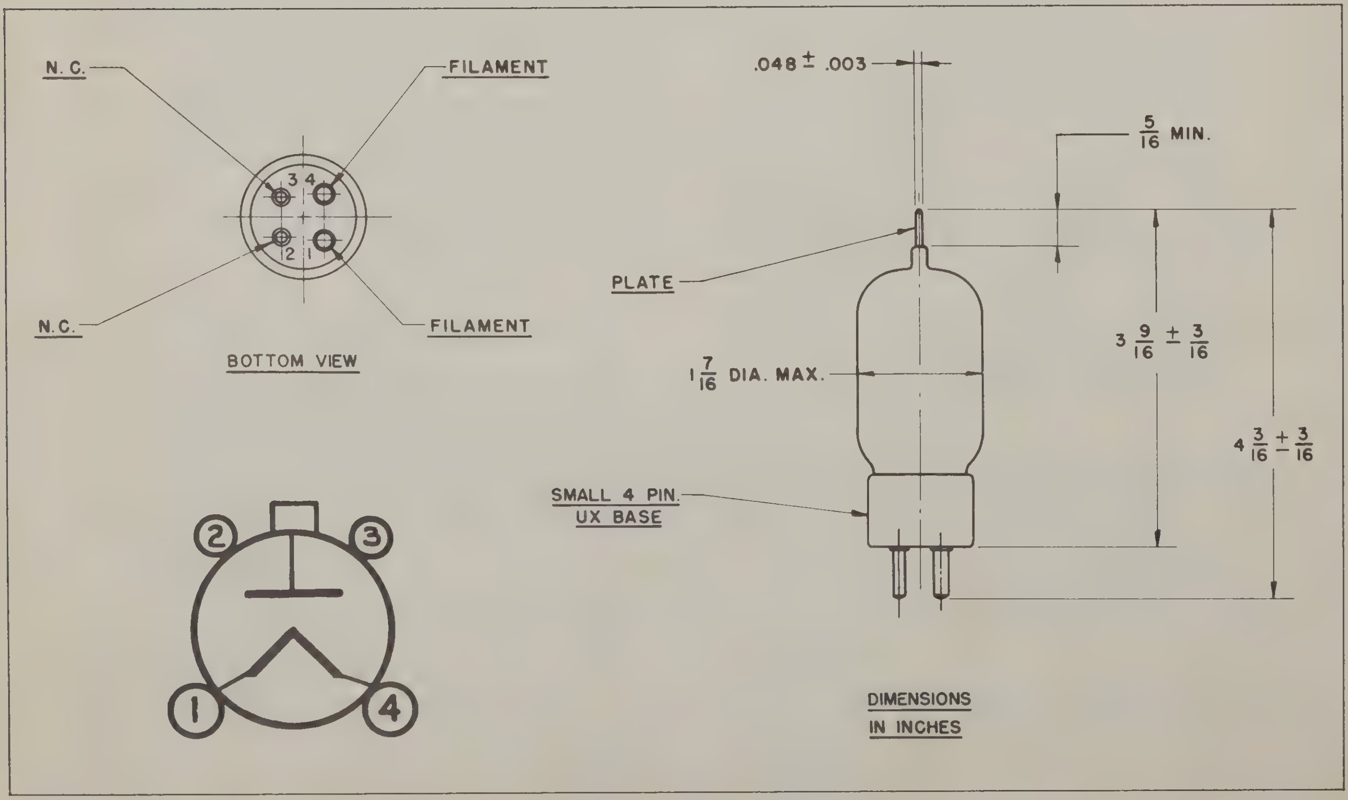
D-C Plate Current (I_p)	35.0	37.5	40.0	42.5	45.0	47.5	50.0	milliamperes per tube
Total Charging-Circuit Resistance (R_c)	1.3	2.0	3.4	5.5	9.0	16	27	percent of Effective Load Resistance per Tube (E_c/I_p)
A-C Supply Voltage (E_{rms})	0.80	0.83	0.88	0.94	1.05	1.23	1.50	times Filter-Input D-C Voltage (E_c)
Peak Inverse Voltage (½ these values for circuit b.)	2.3	2.4	2.5	2.7	3.0	3.5	4.3	times Filter-Input D-C Voltage (E_c)

Fig. 2. Eimac 2-25A Basic R-C Circuits (for any one of the indicated loads)

R_i = Equivalent resistance of voltage source.

R_p = 1200 ohms (600 ohms for two tubes in parallel)





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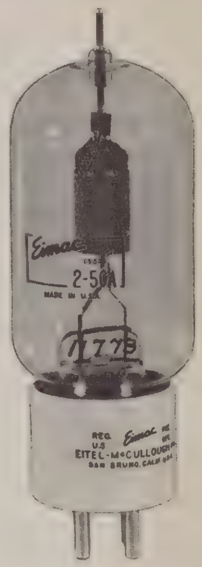
SAN BRUNO, CALIFORNIA

2-50A
HIGH-VACUUM RECTIFIER



The Eimac 2-50A diode is a high-vacuum rectifier intended for use in rectifier units, voltage multipliers, or in special applications, whenever conditions of extreme ambient temperatures, high operating frequency, high peak inverse voltages, or the production of high-frequency transients would prevent the use of gas-filled rectifier tubes.

The 2-50A has a maximum d-c current rating of 75 milliamperes and a maximum peak inverse voltage rating of 30,000 volts. Cooling is by convection and radiation.

A single 2-50A will deliver 60 milliamperes at 12,500 volts to a capacitor-input filter with 10,600 volts single-phase supply. Four 2-50A's in a bridge circuit will deliver 150 milliamperes at 19,000 volts to a choke-input filter with 21,200 volts single-phase supply.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten

Voltage	5.0	volts
Current	4.0	amperes

MECHANICAL

Base	Medium 4-pin bayonet
Basing	Refer to outline drawing
Socket	Refer to discussion under "Application"
Mounting Position	Vertical, base down or up
Cooling	Convection and radiation
Maximum Temperature of Plate Seal	225°C
Recommended Heat Dissipating Plate Connector	Eimac HR-3
Maximum Overall Dimensions:	
Length	5.50 inches
Diameter	1.82 inches
Net Weight	2.5 ounces
Shipping Weight (approx.)	1.0 pound

MAXIMUM RATINGS (Per tube)

PEAK INVERSE PLATE VOLTAGE	30,000 MAX. VOLTS
PLATE DISSIPATION	30 MAX. WATTS
D-C PLATE CURRENT[1]	75 MAX. MA
PEAK PLATE CURRENT	1.0 MAX. AMPERE

[1] Averaged over one cycle for each tube. Applies only when the rectifier is coupled to the load by a choke-input filter incorporating the "critical" value (or larger) of input inductance. For maximum d-c current ratings under this and other load conditions see discussion under "Application".

APPLICATION

MECHANICAL

Mounting—The 2-50A must be mounted vertically with the base either down or up. The lead to the plate terminal of the tube should be flexible.

The medium 4-pin base fits an E. F. Johnson Co. No. 122-224, a National Co. No. XC-4 or CIR-4, or an equivalent socket. In some circuits, particularly those of the voltage multipliers illustrated in Fig. 2, it may be necessary to mount the socket on stand-off insulators, or on a sheet of insulating material, to provide adequate insulation to ground.

Cooling—The 2-50A is cooled by convection and radiation. Clearance should be provided around the glass envelope adequate for the free circulation of air. An Eimac HR-3 Heat Dissipating Connector or equivalent is required on the plate terminal.

The maximum temperature at the plate seal must not exceed 225°C. A convenient accessory for measuring this temperature

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is "Tempilaq" a temperature-sensitive lacquer available from the Tempil Corporation, 132 W. 22nd St., New York 11, N. Y.

ELECTRICAL

Filament Operation—For maximum tube life, the filament voltage, as measured at the base pins, should be the rated value of 5.0 volts. Variations must be kept within the range from 4.75 to 5.25 volts. In applications which require the diode to deliver high peak currents, it is important to maintain the filament voltage at the rated value.

CAUTION SHOULD BE OBSERVED WHEN MEASURING RECTIFIER FILAMENT VOLTAGE. THE FILAMENT CIRCUIT MAY BE AT A HIGH POTENTIAL.

The thoriated-tungsten filament of the 2-50A reaches operating temperature in a fraction of a second after application of voltage. Plate voltage may be applied simultaneously with filament voltage.

Plate Operation—With low room illumination the plate of the 2-50A begins to show color as the maximum plate dissipation rating of 30 watts is approached. The maximum peak inverse voltage rating of 30,000 volts should not be exceeded at any time.

Performance—The accompanying table shows some maximum performance capabilities of the 2-50A when used as a power-supply rectifier.

2-50A MAXIMUM-PERFORMANCE CAPABILITIES

		Capacitor-Input Filter		Choke-Input Filter	
Circuit Type	A-C Input Voltage (volts rms)	D-C Output Voltage (volts)	D-C Output Current (ma)	D-C Output Voltage (volts)	D-C Output Current (ma)
Single-Phase, Half-Wave	10,600	12,500	60	....	....
Single-Phase, Full-Wave	10,600[1]	12,500	120	9500	150
Single-Phase, Bridge	21,200	25,000	120	19,000	150

[1] One-half the transformer secondary voltage.

Maximum D-C Current Ratings—Plate dissipation rather than peak current usually limits the d-c current which the 2-50A is capable of delivering to the load. Because the plate dissipation associated with a given d-c current depends upon the amount of ripple and its wave-shape, circuit conditions will determine the maximum d-c current rating of the tube.

Choke-Input Filter—The maximum d-c current rating of the 2-50A is 75 milliamperes when the load incorporates a choke-input filter with the "critical" value (or larger) of input inductance (L_1 in Fig. 1):

$$L_o = \frac{R_{eff}}{18.8f} \quad \text{for full-wave single-phase rectifiers,}$$

$$L_o = \frac{R_{eff}}{75f} \quad \text{for half-wave three-phase rectifiers,}$$

$$L_o = \frac{R_{eff}}{660f} \quad \text{for full-wave three-phase rectifiers,}$$

where: L_o = "critical" value of input inductance (henries),
f = supply-line frequency (cycles per second),

$$R_{eff} = \frac{\text{Load voltage (volts)}}{\text{Load current (amps)}}.$$

Choke-input filters are not normally used with single-phase half-wave rectifiers.

Capacitor-Input Filter—The 2-50A is particularly suitable for power-supply applications demanding high voltage at low current. Under these conditions capacitor-input filter circuits become desirable. The maximum d-c current rating of the 2-50A when no input choke is incorporated in the filter depends upon the total series resistance of the capacitor-charging circuit relative to the effective load resistance seen by each tube. The circuit diagrams and tabulation in Fig. 2 are so arranged and labeled that this required series resistance may be found for a wide range of load conditions. This may be done by determining the value of the following quantities:

E_c is the filter-input d-c voltage. While this is usually the entire load voltage, in the case of voltage multipliers it is the load voltage divided by the multiplication factor.

I_p is the d-c current per tube. This is the entire load current only in the case of the simple half-wave rectifier or half- or full-wave multiplier. In the case of full-wave center-tapped or bridge rectifiers, I_p is half the load current.

R_c is the total charging-circuit resistance. A certain minimum value of charging-circuit resistance is necessary to limit the peak value of current to which the tubes will be subjected under given load conditions. This required minimum depends upon the d-c current per tube (I_p), and has been tabulated in Fig. 2 as a percentage of the effective load resistance per tube (E_c/I_p). The total charging-circuit resistance involves the internal resistance of the rectifier tube, R_p, the added series resistor, R_s, and the equivalent internal resistance of the a-c voltage supply, R_i.

R_p is the plate resistance of the 2-50A, which may be taken as 1000 ohms.

R_i is the equivalent internal resistance of the supply. This may be taken as the regulation of the high-voltage supply expressed as a decimal multiplied by the load resistance used in measuring this regulation.

R_s is the series resistor which must be inserted in the charging circuit to bring the total charging-circuit resistance up to the required minimum. Its value may be found from the formula associated with each of the circuits of Fig. 2. This resistor must be inserted in such a position in the circuit that it protects all tubes.

Tubes may be operated in parallel to increase the output capability in a given circuit. When two tubes are placed in parallel at each place where one is shown in the circuits of Fig. 2, the plate resistance (R_p) will be half as great and the maximum allowable load current twice as great as indicated.

Peak Inverse Voltage—The peak inverse voltage rating of the 2-50A is 30,000 volts. In single-phase power-supply rectifier circuits the peak inverse voltage to be used in design is the peak a-c supply voltage (1.41 times E_{rms} in Fig. 2) in the case of bridge circuits, and twice this value in the case of half- and full-wave rectifiers and voltage multipliers. Peak inverse voltage in three-phase operation depends upon the circuit employed, and will be found listed in the handbooks.

Special Applications—The ratings given for capacitor-input filter circuits assume values of input capacitance large enough to hold the ripple to a low value. In special applications where a larger percent ripple is tolerable, and filter capacitance is low, the 2-50A is capable of larger d-c output currents.

As a unidirectional conductor in d-c circuits where the current is continuous and the percent ripple is moderate, the maximum current rating of the 2-50A is 145 milliamperes.

The plate characteristic curve for the 2-50A serves as a guide to special applications. The maximum plate dissipation rating of 30 watts, the maximum peak inverse voltage rating of 30,000 volts, and the maximum peak plate current of 1.0 ampere must not be exceeded.

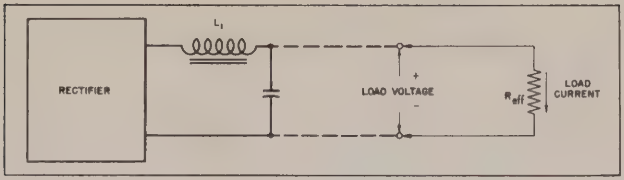
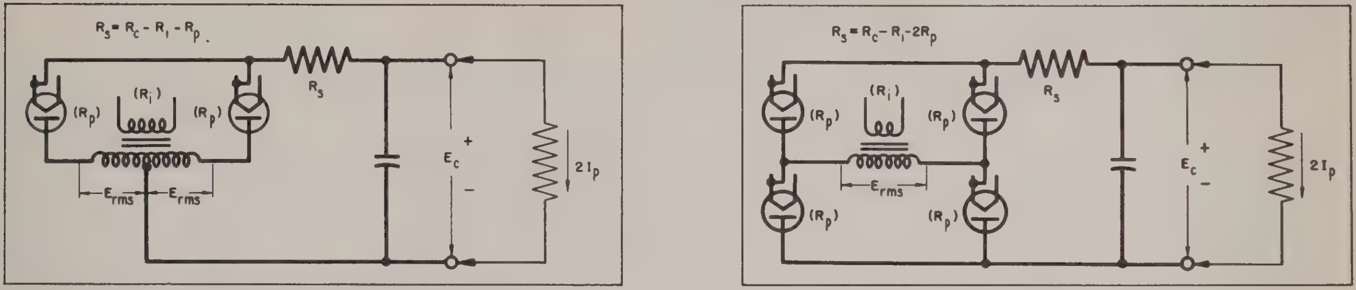
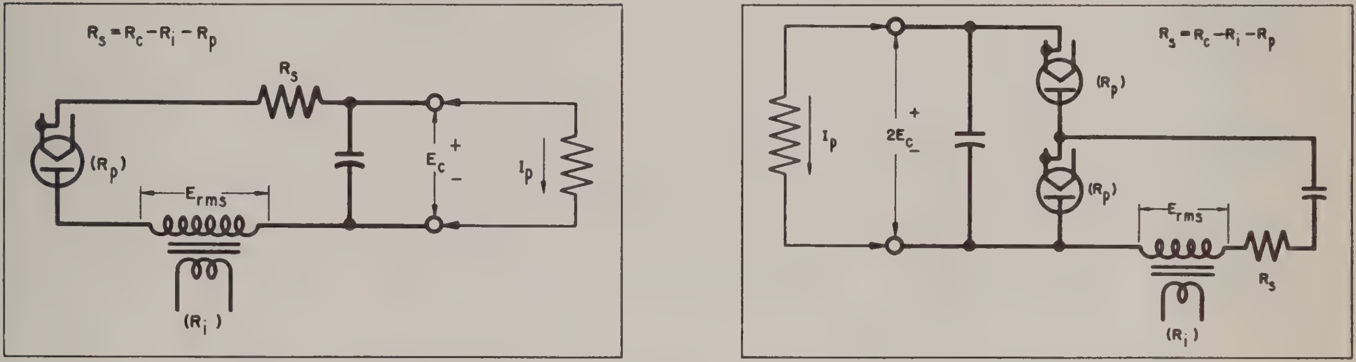


Fig. 1. Rectifier with Choke-Input Filter



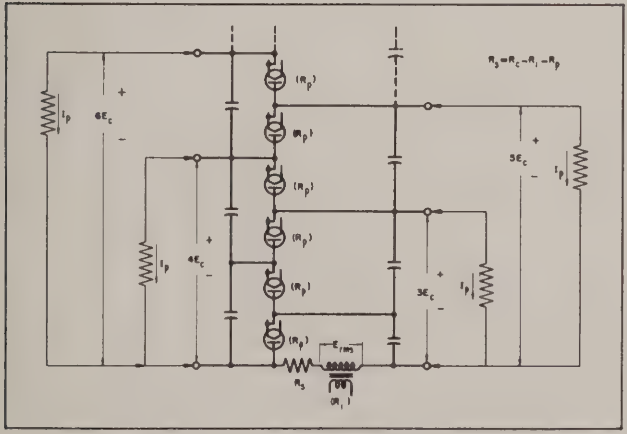
a. Full-Wave Center-Tapped Rectifier

b. Full-Wave Bridge Rectifier

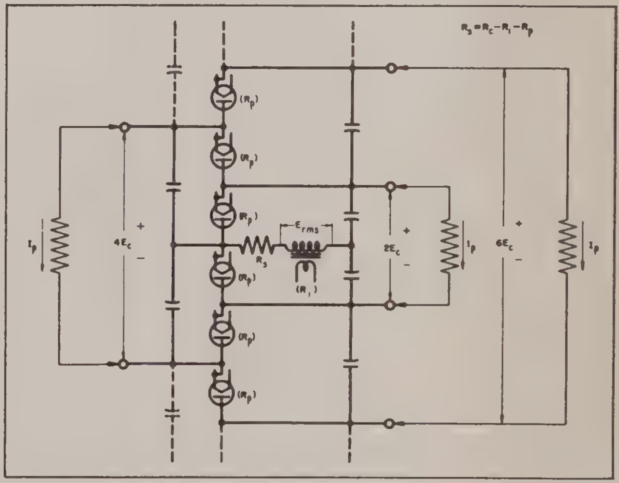


c. Half-Wave Rectifier

d. Half-Wave Voltage Doubler



e. Half-Wave Voltage Multiplier (with common ground when R_s is inserted on the "high" side of E_{rms})



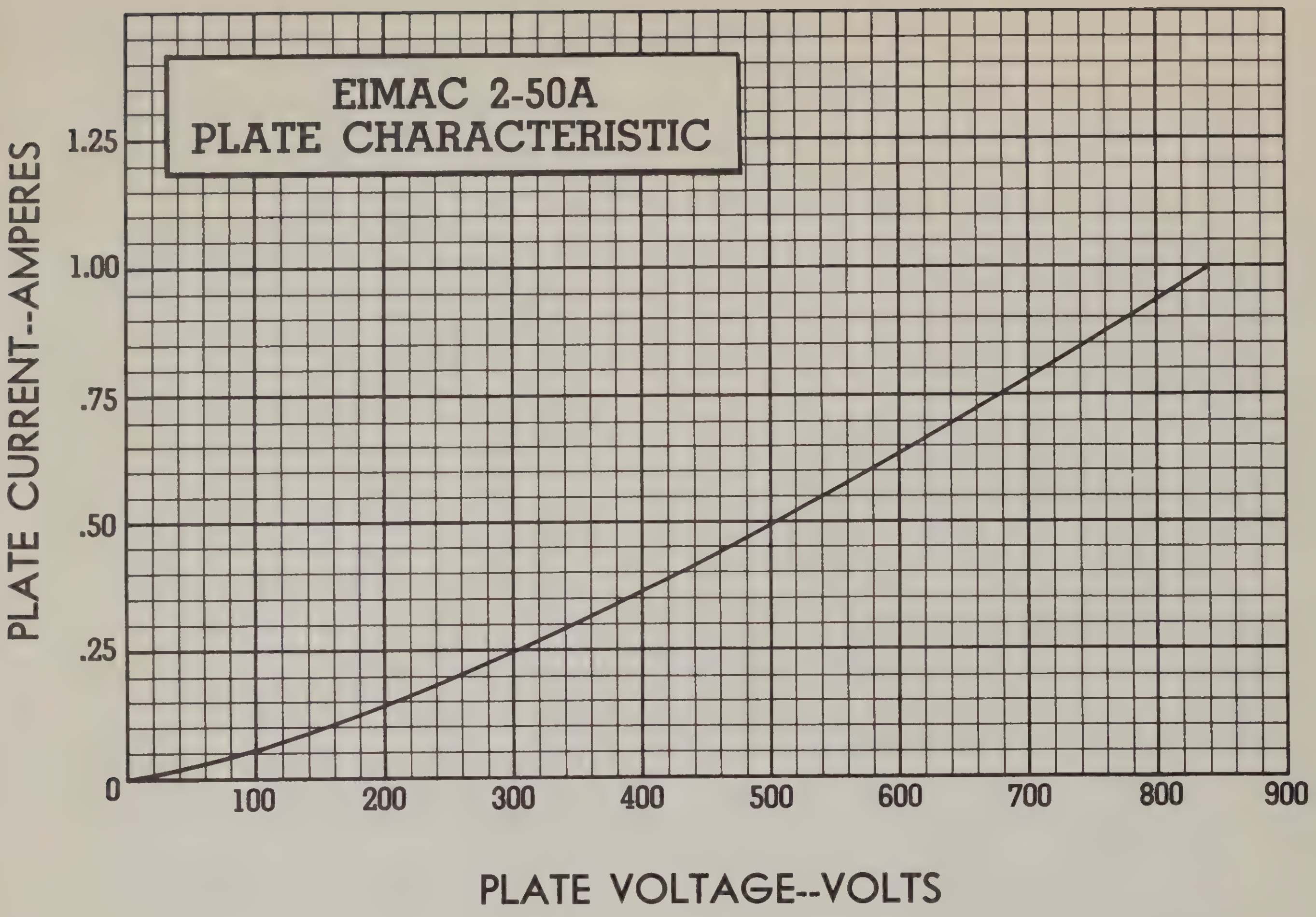
f. Full-Wave Voltage Multiplier

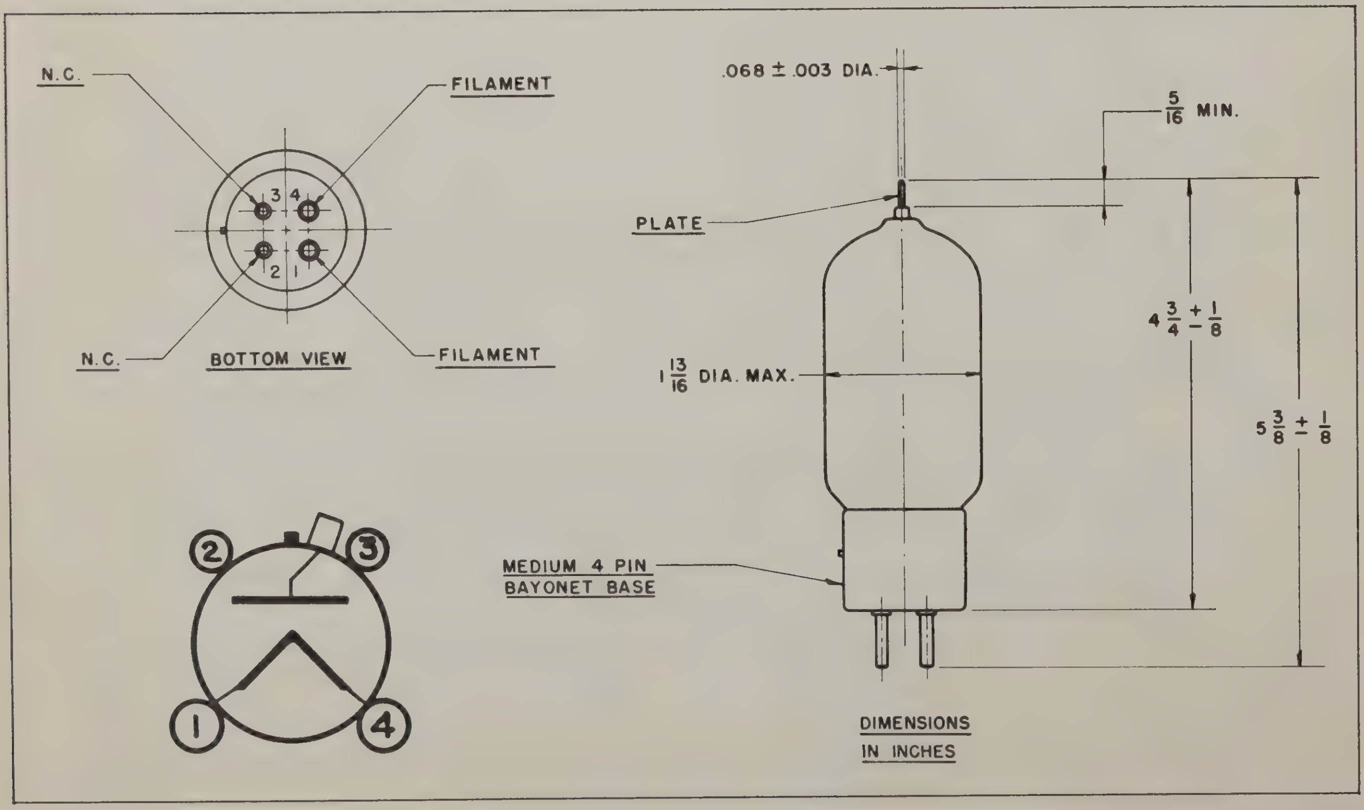
Eimac 2-50A Maxium D-C Current Ratings for R-C Filter Applications						
D-C Plate Current (I_p)	55	60	65	70	75	milliamperes per tube
Total Charging-Circuit Resistance (R_c)	1.3	2.4	4.7	8.5	17	percent of effective Load Resistance per Tube (E_c/I_p)
A-C Supply Voltage (E_{rms})	0.80	0.85	0.92	1.04	1.28	times Filter-Input D-C Voltage (E_c)
Peak Inverse Voltage (½ these values for circuit b.)	2.3	2.4	2.6	3.0	3.7	times Filter-Input D-C Voltage (E_c)

Fig. 2 Eimac 2-50A Basic R-C Circuits (for any one of the indicated loads)

R_i = Equivalent resistance of voltage source

R_p = 1000 ohms (500 ohms for two tubes in parallel)





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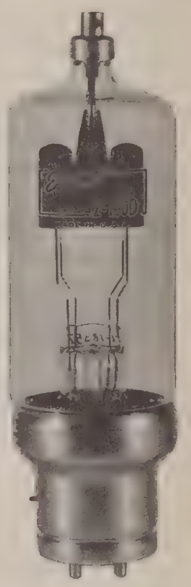
EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

2-150D

HIGH-VACUUM RECTIFIER



The Eimac 2-150D is a high vacuum diode rectifier intended for use in rectifier units, voltage multipliers, or in special applications, whenever conditions of extreme ambient temperatures, high operating frequency, high peak inverse voltages, or the production of high-frequency transients would prevent the use of gas-filled rectifier tubes.

The 2-150D has a maximum d-c current rating of 250 milliamperes and a maximum peak inverse voltage rating of 30,000 volts. Cooling is by convection and radiation.

A single 2-150D will deliver 200 milliamperes at 11,800 volts to a capacitor-input filter with 10,600 volts single-phase supply. Four 2-150D's in a bridge circuit will deliver 500 milliamperes at 19,000 volts to a choke-input filter with 21,200 volts single-phase supply.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten

Voltage	5.0 volts
Current	13.0 amperes

MECHANICAL

Base	50-watt jumbo 4-pin bayonet
Basing	Refer to outline drawing
Socket	Refer to discussion under "Application"
Mounting Position	Vertical, base down or up
Cooling	Convection and Radiation
Maximum Temperature of Plate Seal	225°C
Recommended Heat Dissipating Plate Connector	Eimac HR-6
Maximum Over-all Dimensions:	
Length	8.88 inches
Diameter	2.50 inches
Net Weight	9 ounces
Shipping Weight (approx.)	1 pound

MAXIMUM RATINGS (Per tube)

PEAK INVERSE PLATE VOLTAGE	30,000 MAX. VOLTS
PLATE DISSIPATION	90 MAX. WATTS
D-C PLATE CURRENT[1]	250 MAX. MA
PEAK PLATE CURRENT	3.0 MAX. AMPERES

[1] Averaged over one cycle for each tube. Applies only when the rectifier is coupled to the load by a choke-input filter incorporating the "critical" value (or larger) of input inductance. For maximum d-c current ratings under this and other load conditions see discussion under "Application".

APPLICATION

MECHANICAL

Mounting—The 2-150D must be mounted vertically with the base either down or up. The lead to the plate terminal of the tube should be flexible.

The 50-watt jumbo 4-pin bayonet base fits an E. F. Johnson Co. No. 123-211, a National Co. No. XM-50, or an equivalent socket. In some circuits, particularly those of the voltage multipliers illustrated in Fig. 2, it may be necessary to mount the socket on stand-off insulators, or on a sheet of insulating material, to provide adequate insulation to ground.

Cooling—The 2-150D is cooled by convection and radiation. Clearance should be provided around the glass envelope adequate for the free circulation of air. An Eimac HR-6 Heat Dissipating Connector or equivalent is required on the plate terminal.

The maximum temperature at the plate seal must not exceed 225°C. A convenient accessory for measuring this temperature

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APPLICATION (Continued)

is "Tempilaq", a temperature-sensitive lacquer available from the Tempil Corporation, 132 W. 22nd Street, New York 11, N. Y.

ELECTRICAL

Filament Operation—For maximum tube life, the filament voltage, as measured at the base pins, should be the rated value of 5.0 volts. Variations must be kept within the range from 4.75 to 5.25 volts. In applications which require the diode to deliver high peak currents, it is important to maintain the filament voltage at the rated value.

> CAUTION SHOULD BE OBSERVED WHEN MEASURING RECTIFIER FILAMENT VOLTAGE. THE FILAMENT CIRCUIT MAY BE AT HIGH POTENTIAL.

The thoriated-tungsten filament of the 2-150D reaches operating temperature in a fraction of a second after application of voltage. Plate voltage may be applied simultaneously with filament voltage.

Plate Operation—With low room illumination, the plate of the 2-150D begins to show color as the maximum plate dissipation rating of 90 watts is approached. The maximum peak inverse voltage rating of 30,000 volts should not be exceeded at any time.

Performance—The accompanying table shows some maximum performance capabilities of the 2-150D when used as a power-supply rectifier.

2-150D MAXIMUM-PERFORMANCE CAPABILITIES

Circuit Type	A-C Input Voltage (volts rms)	Capacitor-Input Filter D-C Output Voltage (volts)	Capacitor-Input Filter D-C Output Current (ma)	Choke-Input Filter D-C Output Voltage (volts)	Choke-Input Filter D-C Output Current (ma)
Single-Phase, Half-Wave	10,600	11,800	200	......	. . .
Single-Phase, Full-Wave	10,600[1]	11,800	400	9500	500
Single-Phase, Bridge	21,200	23,600	400	19,000	500

[1] One-half the transformer secondary voltage.

Maximum D-C Current Ratings—Plate dissipation rather than peak current usually limits the d-c current which the 2-150D is capable of delivering to the load. Because the plate dissipation associated with a given d-c current depends upon the amount of ripple and its wave-shape, circuit conditions will determine the maximum d-c current rating of the tube.

Choke-Input Filter—The maximum d-c current rating of the 2-150D is 250 milliamperes when the load incorporates a choke-input filter with the "critical" value (or larger) of input inductance (L_1 in Fig. 1):

$$L_o = \frac{R_{eff}}{18.8f} \quad \text{for full-wave single-phase rectifiers,}$$

$$L_o = \frac{R_{eff}}{75f} \quad \text{for half-wave three-phase rectifiers,}$$

$$L_o = \frac{R_{eff}}{660f} \quad \text{for full-wave three-phase rectifiers,}$$

where: L_o = "critical" value of input inductance (henries),
f = supply-line frequency (cycles per second),

$$R_{eff} = \frac{\text{Load voltage (volts)}}{\text{Load current (amps)}}.$$

Choke-input filters are not normally used with single-phase half-wave rectifiers.

Capacitor-Input Filter—The 2-150D is particularly suitable for power-supply applications demanding high voltage at low current. Under these conditions capacitor-input filter circuits become desirable. The maximum d-c current rating of the 2-150D when no input choke is incorporated in the filter depends upon the total series resistance of the capacitor-charging circuit relative to the effective load resistance seen by each tube. The circuit diagrams and tabulation in Fig. 2 are so arranged and labeled that this required series resistance may be found for a wide range of load conditions. This may be done by determining the value of the following quantities:

E_c is the filter-input d-c voltage. While this is usually the entire load voltage, in the case of voltage multipliers it is the load voltage divided by the multiplication factor.

I_p is the d-c current per tube. This is the entire load current only in the case of the simple half-wave rectifier or half- or full-wave multiplier. In the case of full-wave center-tapped or bridge rectifiers, I_p is half the load current.

R_c is the total charging-circuit resistance. A certain minimum value of charging-circuit resistance is necessary to limit the peak value of current to which the tubes will be subjected under given load conditions. This required minimum depends upon the d-c current per tube (I_p), and has been tabulated in Fig. 2 as a percentage of the effective load resistance per tube (E_c/I_p). The total charging-circuit resistance involves the internal resistance of the rectifier tube, R_p, the added series resistor, R_s, and the equivalent internal resistance of the a-c voltage supply, R_i.

R_p is the plate resistance of the 2-150D, which may be taken as 300 ohms.

R_i is the equivalent internal resistance of the supply. This may be taken as the regulation of the high-voltage supply expressed as a decimal multiplied by the load resistance used in measuring this regulation.

R_s is the series resistor which must be inserted in the charging circuit to bring the total charging-circuit resistance up to the required minimum. Its value may be found from the formula associated with each of the circuits of Fig. 2. This resistor must be inserted in such a position in the circuit that it protects all tubes.

Tubes may be operated in parallel to increase the output capability in a given circuit. When two tubes are placed in parallel at each place where one is shown in the circuits of Fig. 2, the plate resistance (R_p) will be half as great and the load maximum allowable load current twice as great as indicated.

Peak Inverse Voltage—The peak inverse voltage rating of the 2-150D is 30,000 volts. In single-phase power-supply rectifier circuits the peak inverse voltage to be used in design is the peak a-c supply voltage (1.41 times E_{rms} in Fig. 2) in the case of bridge circuits, and twice this value in the case of half- and full-wave rectifiers and voltage multipliers. Peak inverse voltage in three-phase operation depends upon the circuit employed, and will be found listed in the handbooks.

Special Applications—The ratings given for capacitor-input filter circuits assume values of input capacitance large enough to hold the ripple to a low value. In special applications where a larger percent ripple is tolerable, and filter capacitance is low, the 2-150D is capable of larger d-c output currents.

As a unidirectional conductor in d-c circuits where the current is continuous and the percent ripple is moderate, the maximum current rating of the 2-150D is 500 milliamperes.

The plate characteristic curve for the 2-150D serves as a guide to special applications. The maximum plate dissipation rating of 90 watts, the maximum peak inverse voltage rating of 30,000 volts, and the maximum peak plate current of 3.0 amperes must not be exceeded.

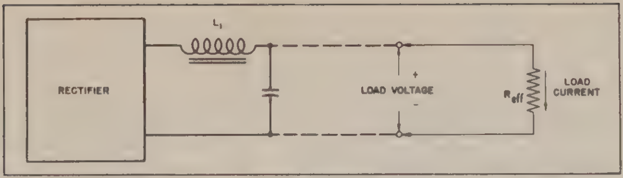
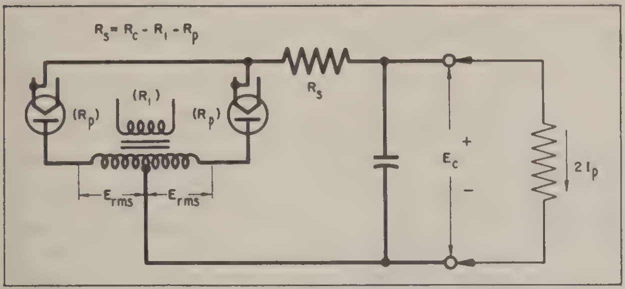
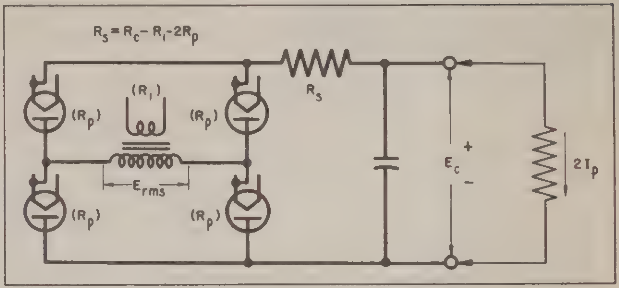


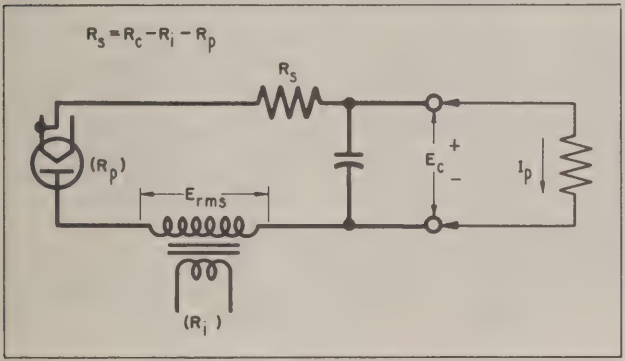
Fig. 1. Rectifier with Choke-Input Filter



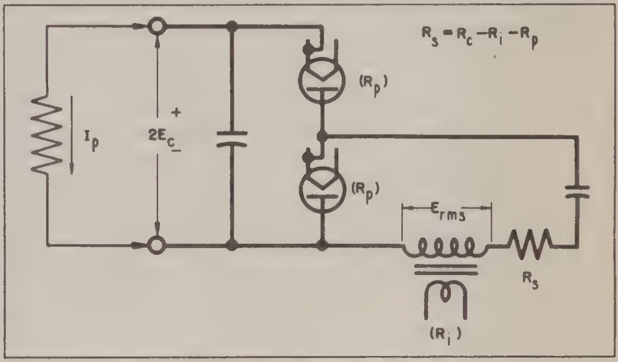
a. Full-Wave Center-Tapped Rectifier



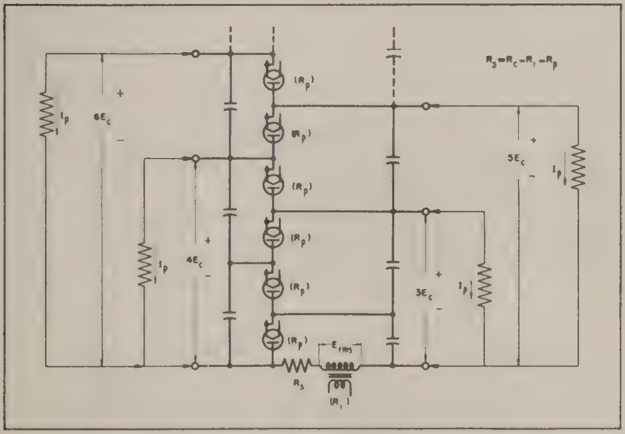
b. Full-Wave Bridge Rectifier



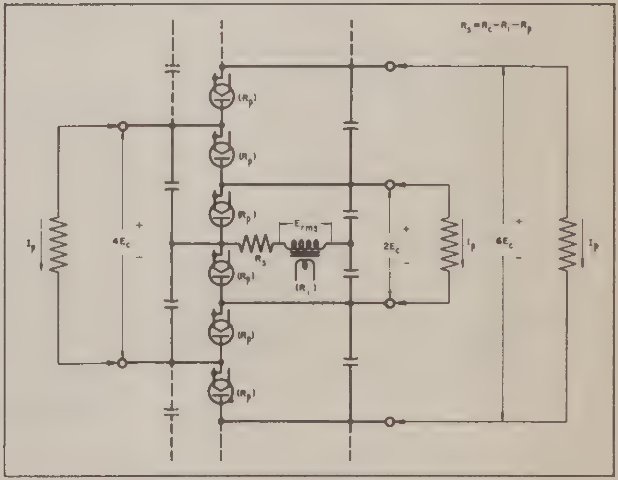
c. Half-Wave Rectifier



d. Half-Wave Voltage Doubler



e. Half-Wave Voltage Multiplier (with common ground when R_s is inserted on the "high" side of E_{rms})

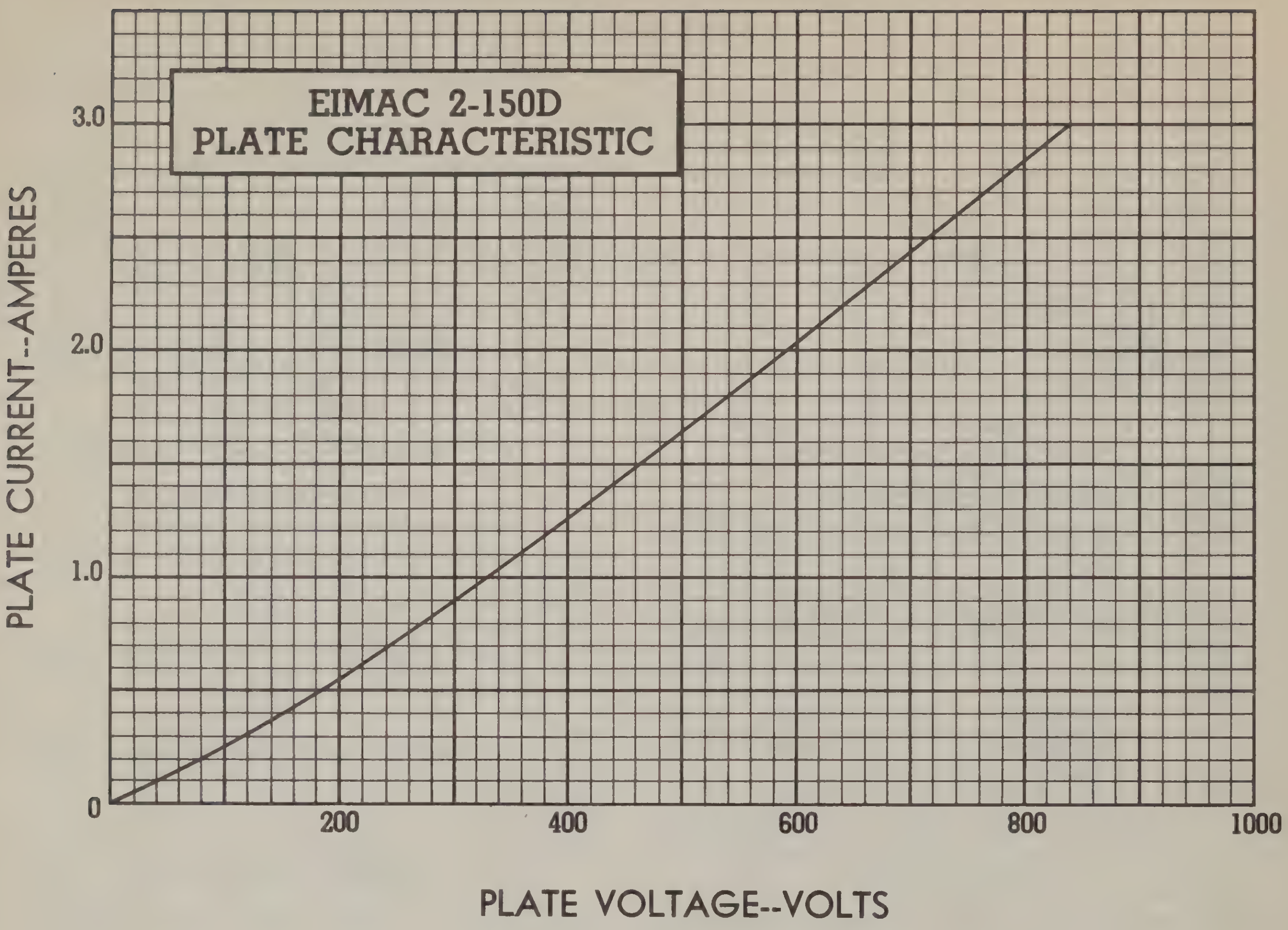


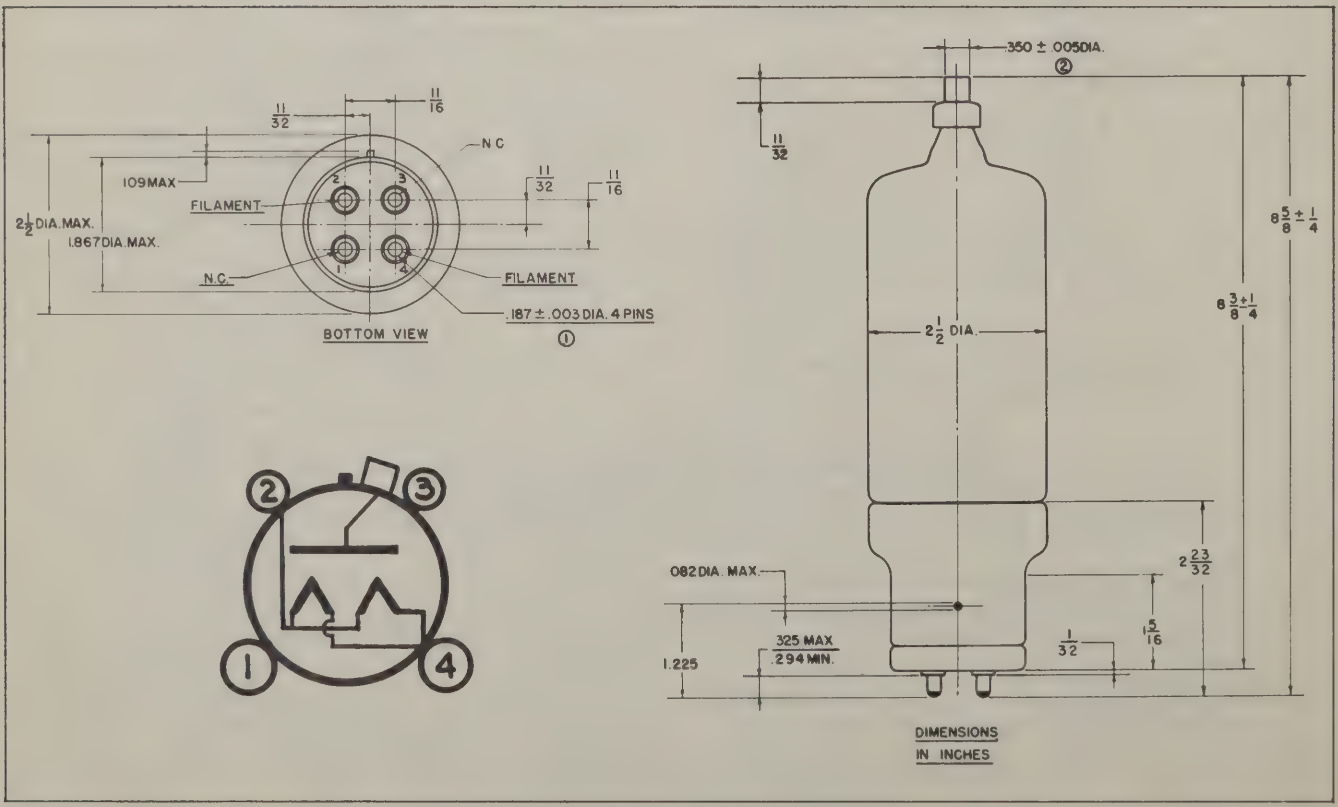
f. Full-Wave Voltage Multiplier

Eimac 2-150D Maximum D-C Current Ratings for R-C Filter Applications

D-C Plate Current (I_p)	150	175	200	225	250	milliamperes per tube
Total Charging-Circuit Resistance (R_c)	0.7	1.6	3.9	9.6	27	percent of Effective Load Resistance per Tube (E_c/I_p)
A-C Supply Voltage (E_{rms})	0.78	0.82	0.90	1.07	1.50	times Filter-Input D-C Voltage (E_c)
Peak Inverse Voltage (1/2 these values for circuit b.)	2.2	2.4	2.6	3.0	4.3	times Filter-Input D-C Voltage (E_c)

Fig. 2 Eimac 2-150D Basic R-C Circuits (for any one of the indicated loads)
R_i = Equivalent resistance of voltage source
R_p = 300 ohms (150 ohms for two tubes in parallel)


EIMAC 2-150D
PLATE CHARACTERISTIC
PLATE CURRENT--AMPERES
3.0
2.0
1.0
0
200
400
600
800
1000
PLATE VOLTAGE--VOLTS


11/32
11/16
N C
109 MAX
FILAMENT
2 1/2 DIA. MAX.
1.867 DIA. MAX.
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FILAMENT
11/32
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2
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1
4
.187 ± .003 DIA. 4 PINS
①
BOTTOM VIEW
2
3
1
4
.350 ± .005 DIA.
②
11/32
8 5/8 ± 1/4
8 3/8 ± 1/4
2 1/2 DIA.
2 23/32
.082 DIA. MAX.
1 5/16
1/32
.325 MAX
.294 MIN.
1.225
DIMENSIONS
IN INCHES

Eimac®

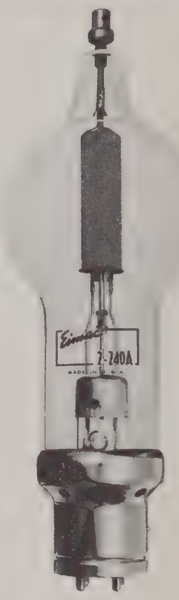
EITEL-McCULLOUGH, INC.
SAN CARLOS · CALIFORNIA

2-240A
HIGH-VACUUM RECTIFIER

The Eimac 2-240A is a high vacuum diode rectifier intended for use in rectifier units, voltage multipliers, or in special applications, whenever conditions of extreme ambient temperatures, high operating frequency, high peak inverse voltages, or the production of high-frequency transients would prevent the use of gas-filled rectifier tubes.

The 2-240A has a maximum d-c current rating of 500 milliamperes and a maximum peak inverse voltage rating of 25,000 volts. Cooling is by convection and radiation.

A single 2-240A will deliver 320 milliamperes at 10,000 volts to a capacitor-input filter with 9,000 volts single-phase supply. Four 2-240A's in a bridge circuit will deliver 1.0 ampere at 16,000 volts to a choke-input filter with 18,000 volts single-phase supply.



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GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten

Voltage	7.5 volts
Current	12.0 amperes

MECHANICAL

Base	50-watt jumbo 4-pin bayonet
Basing	Refer to outline drawing
Socket	Refer to discussion under "Application"
Mounting Position	Vertical, base down or up
Cooling	Convection and radiation
Maximum Temperature of Plate Seal	225°C
Recommended Heat Dissipating Plate Connector	Eimac HR-6
Maximum Over-all Dimensions:	
Length	11.2 inches
Diameter	3.82 inches
Net Weight	10 ounces
Shipping Weight (approx.)	3 pounds

MAXIMUM RATINGS (Per tube)

PEAK INVERSE PLATE VOLTAGE	25,000 MAX. VOLTS
PLATE DISSIPATION	150 MAX. WATTS
D-C PLATE CURRENT[1]	500 MAX. MA
PEAK PLATE CURRENT	4.0 MAX. AMPERES

[1] Averaged over one cycle for each tube. Applies only when the rectifier is coupled to the load by a choke-input filter incorporating the "critical" value (or larger) of input inductance. For maximum d-c current ratings under this and other load conditions see discussion under "Application".

APPLICATION

MECHANICAL

Mounting—The 2-240A must be mounted vertically with the base either down or up. The lead to the plate terminal of the tube should be flexible.

The 50-watt jumbo 4-pin bayonet base fits an E. F. Johnson Co. No. 123-211, a National Co. No. XM-50, or an equivalent socket. In some circuits, particularly those of the voltage multipliers illustrated in Fig. 2, it may be necessary to mount the socket on stand-off insulators, or on a sheet of insulating material, to provide adequate insulation to ground.

Cooling—The 2-240A is cooled by convection and radiation. Clearance should be provided around the glass envelope adequate for the free circulation of air. An Eimac HR-6 Heat Dissipating Connector or equivalent is required on the plate terminal.

The maximum temperature at the plate seal must not exceed

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▶ Indicates Change From Sheet Dated 10-31-57

225°C. A convenient accessory for measuring this temperature is "Tempilaq", a temperature-sensitive lacquer available from the Tempil Corporation, 132 W. 22nd St., New York 11, N. Y.

ELECTRICAL

Filament Operation—For maximum tube life, the filament voltage, as measured at the base pins, should be the rated value of 7.5 volts. Variations must be kept within the range from 7.15 to 7.85 volts. In applications which require the diode to deliver high peak currents, it is important to maintain the filament voltage at the rated value. All four socket terminals should be used, placing two in parallel for each filament connection.

> CAUTION SHOULD BE OBSERVED WHEN MEASURING RECTIFIER FILAMENT VOLTAGE. THE FILAMENT CIRCUIT MAY BE AT HIGH POTENTIAL.

The thoriated-tungsten filament of the 2-240A reaches operating temperature in a fraction of a second after application of voltage. Plate voltage may be applied simultaneously with filament voltage. All four socket terminals should be used, putting two in parallel for each filament connection.

Plate Operation—With low room illumination, the plate of the 2-240A begins to show color as the maximum plate dissipation rating of 150 watts is approached. The maximum peak inverse voltage rating of 25,000 volts should not be exceeded at any time.

Performance—The accompanying table shows some maximum performance capabilities of the 2-240A when used as a power-supply rectifier.

2-240A MAXIMUM-PERFORMANCE CAPABILITIES

		Capacitor-Input Filter		Choke-Input Filter	
Circuit Type	A-C Input Voltage (volts rms)	D-C Output Voltage (volts)	D-C Output Current (amperes)	D-C Output Voltage (volts)	D-C Output Current (amperes)
Single-Phase, Half-Wave	9,000	10,000	0.320	....	....
Single-Phase, Full-Wave	9,000[1]	10,000	0.640	8,000	1.00
Single-Phase, Bridge	18,000	20,000	0.640	16,000	1.00

[1] One-half the transformer secondary voltage.

Maximum D-C Current Ratings—Plate dissipation rather than peak current usually limits the d-c current which the 2-240A is capable of delivering to the load. Because the plate dissipation associated with a given d-c current depends upon the amount of ripple and its wave-shape, circuit conditions will determine the maximum d-c current rating of the tube.

Choke-Input Filter—The maximum d-c current rating of the 2-240A is 500 milliamperes when the load incorporates a choke-input filter with the "critical" value (or larger) of input inductance (L_1 in Fig. 1):

$$L_o = \frac{R_{eff}}{18.8f}$$ for full-wave single-phase rectifiers,

$$L_o = \frac{R_{eff}}{75f}$$ for half-wave three-phase rectifiers,

$$L_o = \frac{R_{eff}}{660f}$$ for full-wave three-phase rectifiers,

where: L_o = "critical" value of input inductance (henries),
f = supply-line frequency (cycles per second),

$$R_{eff} = \frac{\text{Load voltage (volts)}}{\text{Load current (amps)}}.$$

Choke-input filters are not normally used with single-phase half-wave rectifiers.

Capacitor-Input Filter—The 2-240A is particularly suitable for power-supply applications demanding high voltage at low current. Under these conditions capacitor-input filter circuits become desirable. The maximum d-c current rating of the 2-240A when no input choke is incorporated in the filter depends upon the total series resistance of the capacitor-charging circuit relative to the effective load resistance seen by each tube. The circuit diagrams and tabulation in Fig. 2 are so arranged and labeled that this required series resistance may be found for a wide range of load conditions. This may be done by determining the value of the following quantities:

E_c is the filter-input d-c voltage. While this is usually the entire load voltage, in the case of voltage multipliers it is the load voltage divided by the multiplication factor.

I_p is the d-c current per tube. This is the entire load current only in the case of the simple half-wave rectifier or half- or full-wave multiplier. In the case of full-wave center-tapped or bridge rectifiers, I_p is half the load current.

R_c is the total charging-circuit resistance. A certain minimum value of charging-circuit resistance is necessary to limit the peak value of current to which the tubes will be subjected under given load conditions. This required minimum depends upon the d-c current per tube (I_p), and has been tabulated in Fig. 2 as a percentage of the effective load resistance per tube (E_c/I_p). The total charging-circuit resistance involves the internal resistance of the rectifer tube, R_p, the added series resistor, R_s, and the equivalent internal resistance of the a-c voltage supply, R_i.

R_p is the plate resistance of the 2-240A, which may be taken as 200 ohms.

R_i is the equivalent internal resistance of the supply. This may be taken as the regulation of the high-voltage supply expressed as a decimal multiplied by the load resistance used in measuring this regulation.

R_s is the series resistor which must be inserted in the charging circuit to bring the total charging-circuit resistance up to the required minimum. Its value may be found from the formula associated with each of the circuits of Fig. 2. This resistor must be inserted in such a position in the circuit that it protects all tubes.

Tubes may be operated in parallel to increase the output capability in a given circuit. When two tubes are placed in parallel at each place where one is shown in the circuits of Fig. 2, the plate resistance (R_p) will be half as great and the maximum allowable load current twice as great as indicated.

Peak Inverse Voltage—The peak inverse voltage rating of the 2-240A is 25,000 volts. In single-phase power-supply rectifier circuits the peak inverse voltage to be used in design is the peak a-c supply voltage (1.41 times E_{rms} in Fig. 2) in the case of bridge circuits, and twice this value in the case of half- and full-wave rectifiers and voltage multipliers. Peak inverse voltage in three-phase operation depends upon the circuit employed and will be found listed in the handbooks.

Special Applications—The ratings given for capacitor-input filter circuits assume values of input capacitance large enough to hold the ripple to a low value. In special applications where a larger percent ripple is tolerable, and filter capacitance is low, the 2-240A is capable of larger d-c output currents.

As a unidirectional conductor in d-c circuits where the current is continuous and the percent ripple is moderate, the maximum current rating of the 2-240A is 800 milliamperes.

The plate characteristic curve for the 2-240A serves as a guide to special applications. The maximum plate dissipation rating of 150 watts, the maximum peak inverse voltage rating of 25,000 volts, and the maximum peak plate current of 4.0 amperes must not be exceeded.

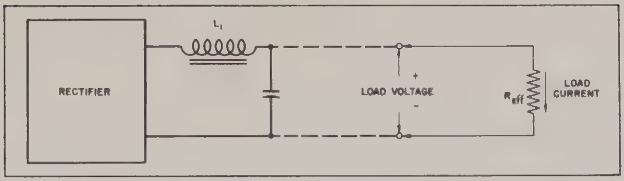
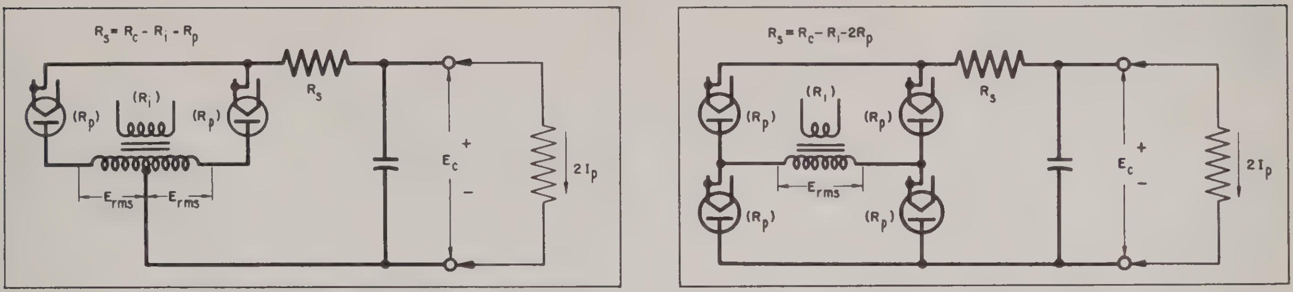
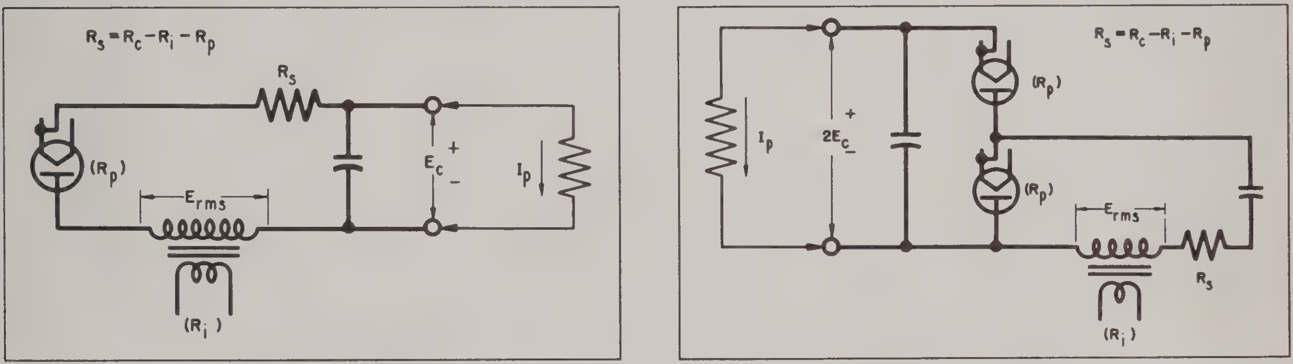


Fig. 1. Rectifier with Choke-Input Filter



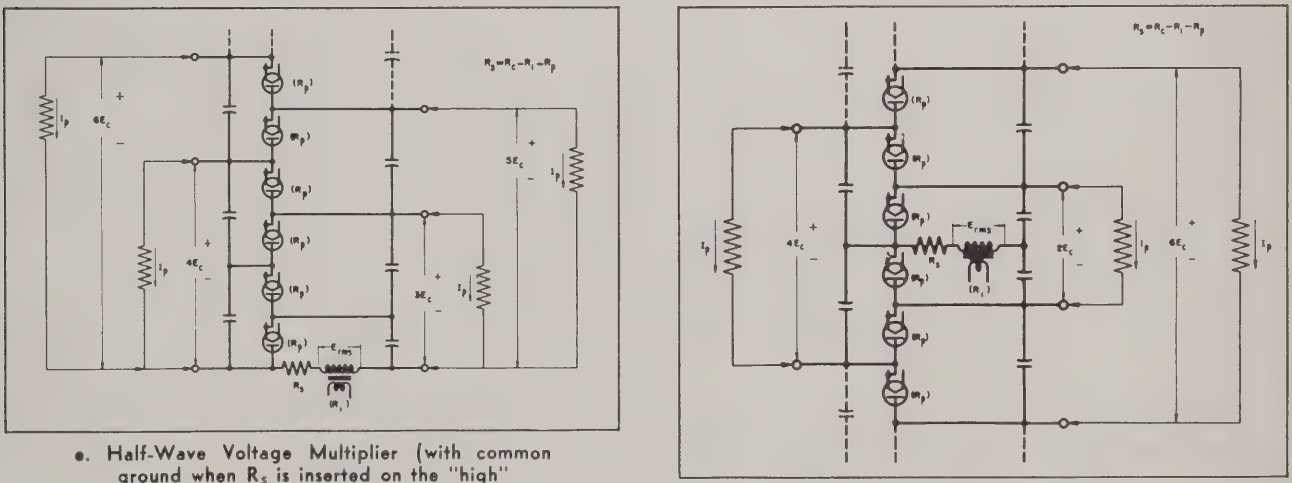
a. Full-Wave Center-Tapped Rectifier

b. Full-Wave Bridge Rectifier



c. Half-Wave Rectifier

d. Half-Wave Voltage Doubler

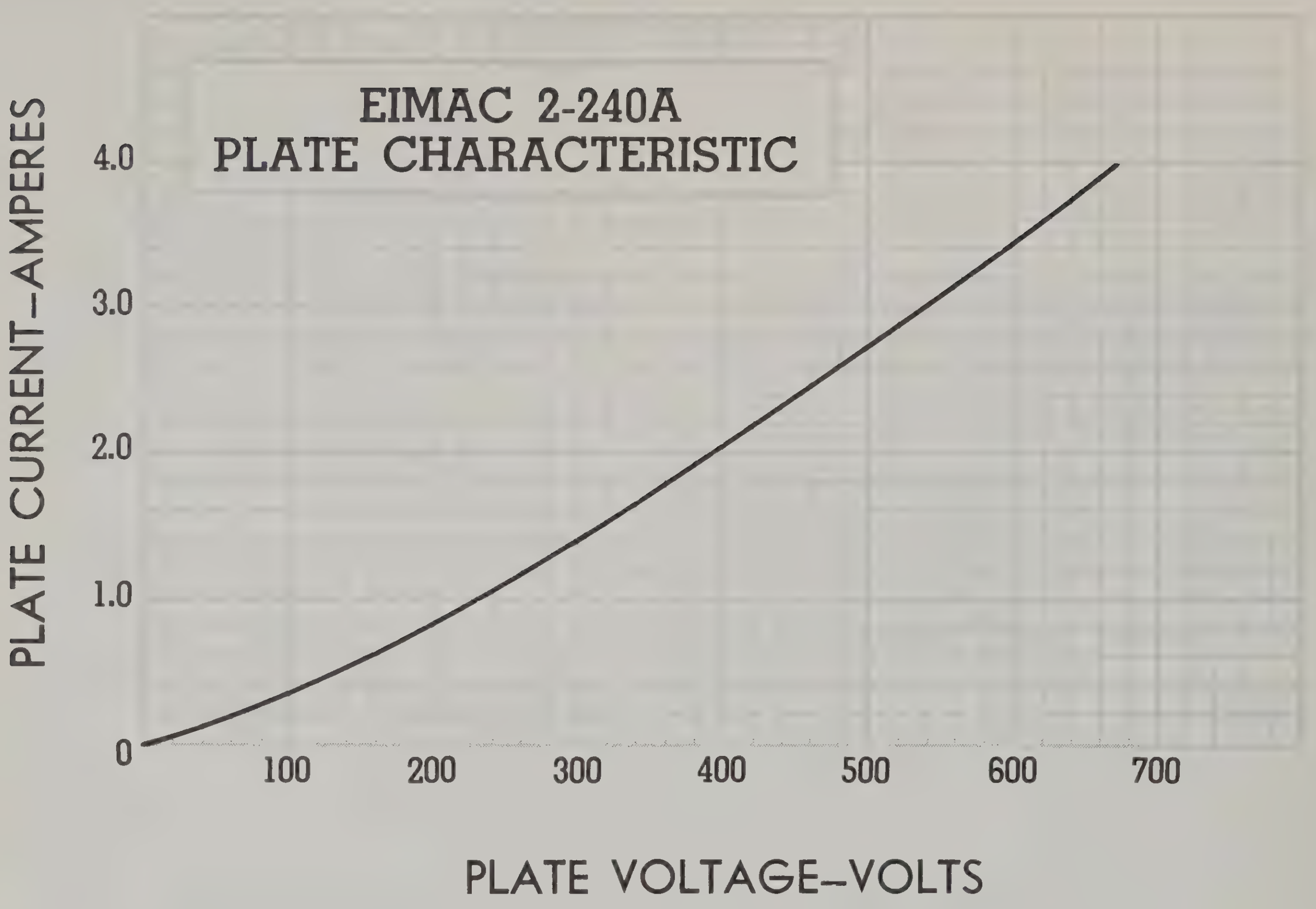


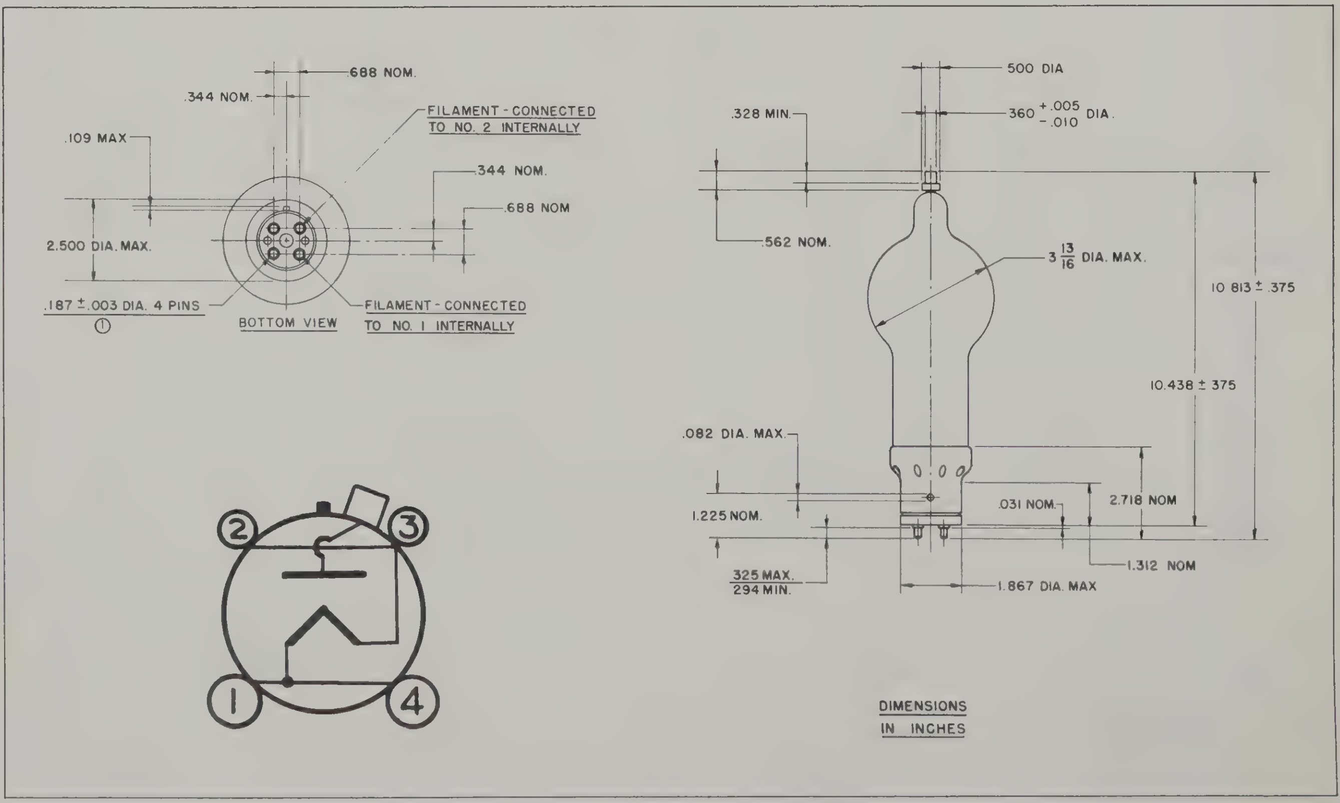
e. Half-Wave Voltage Multiplier (with common ground when R_s is inserted on the "high" side of E_{rms})

f. Full-Wave Voltage Multiplier

Eimac 2-240A Maximum D-C Current Ratings for R-C Filter Applications								
D-C Plate Current (I_p)	280	300	320	340	360	380	400	milliamperes per tube
Total Charging-Circuit Resistance (R_c)	1.0	1.8	3.0	5.0	7.5	12	20	percent of Effective Load Resistance per Tube (E_c/I_p)
A-C Supply Voltage (E_{rms})	0.80	0.83	0.87	0.94	1.01	1.14	1.33	times Filter-Input D-C Voltage (E_c)
Peak-Inverse Voltage (1/2 these values for circuit b.)	2.3	2.4	2.5	2.7	2.9	3.2	3.8	times Filter-Input D-C Voltage (E_c)

Fig. 2 Eimac 2-240A Basic R-C Circuits (for any one of the indicated loads)
R_i = Equivalent resistance of voltage source
R_p = 200 ohms (100 ohms for two tubes in parallel)





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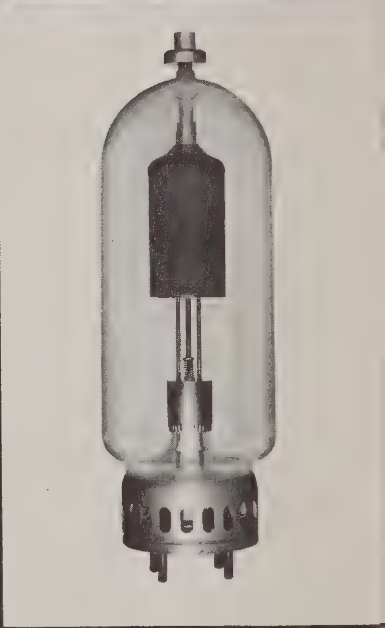
EITEL-McCULLOUGH, INC.
SAN CARLOS · CALIFORNIA

2-450A

HIGH-VACUUM RECTIFIER



The Eimac 2-450A is a high-vacuum diode rectifier intended for use in rectifier units, voltage multipliers, or in special applications where high peak-inverse voltages, extreme temperatures, high operating frequency, or the production of high-frequency transients would prevent the use of mercury-vapor or gas-filled rectifier tubes.

CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten	Min.	Nom.	Max.	
Voltage		7.5		volts
Current	25.0		28.0	amperes

MECHANICAL

Base	4-pin, metal shell
Socket	E. F. Johnson Co. 124-214 or equivalent
Operating Position	Vertical, base down or up
Recommended Plate Connector	Eimac HR-8
Maximum Operating Temperatures:	
Plate Seal	225° C
Envelope	250° C
Net Weight	2.4 pounds
Shipping Weight (approximate)	9 pounds

COOLING

The temperature of the plate seal and envelope must not be allowed to exceed 225°C and 250°C respectively. When several tubes are being operated in the same compartment and at or near maximum rated plate dissipation, forced-air cooling is required. In any event, it should be remembered that the listed temperatures are maximums and that lower operating temperatures will result in longer life and improved reliability. The use of a temperature-sensitive paint, sparingly applied in the referenced areas, is recommended to determine the effectiveness of the cooling employed in any given installation.

MAXIMUM RATINGS

▶ Peak Inverse Plate Voltage	30,000 MAX. VOLTS
Plate Dissipation	450 MAX. WATTS
D-C Plate Current	1 MAX. AMPERE
Peak Plate Current	8 MAX. AMPERES

▶ MAXIMUM POWER-SUPPLY CAPABILITIES*

Circuit	Maximum A-C Input Voltage (volts rms)	Approx. D-C Output Voltage (volts)	Maximum D-C Output Current (amps)
Single-Phase, Full-Wave (2 tubes)	21,200 total	9,300	2.0
Single Phase, Bridge (4 tubes)	21,200 total	18,600	2.0
Three-Phase, Full-Wave (6 tubes)	12,250 per leg	28,000	3.0

*Choke-input filter with L equal to or greater than twice "critical"; zero circuit loss assumed; tube drop considered.

CHOKE-INPUT FILTER

The maximum d-c current rating of the 2-450A is 1.0 ampere when the load incorporates a choke-input filter with the "critical" value (or larger) of input inductance. This value may be calculated from the appropriate formula below:

$$L_0 = \frac{R_{eff}}{18.8f} \left\{ \begin{array}{l} \text{for full-wave} \\ \text{single wave} \\ \text{power supplies} \end{array} \right. \qquad L_0 = \frac{R_{eff}}{75f} \left\{ \begin{array}{l} \text{for half-wave} \\ \text{three-phase} \\ \text{power supplies} \end{array} \right. \qquad L_0 = \frac{R_{eff}}{660f} \left\{ \begin{array}{l} \text{for full-wave} \\ \text{three-phase} \\ \text{power supplies} \end{array} \right.$$

Where: L_0 = "critical" value of input inductance (henries)
f = supply-line frequency (cycles per second)

$$R_{eff} = \frac{\text{load voltage (volts)}}{\text{load current (amps)}}$$

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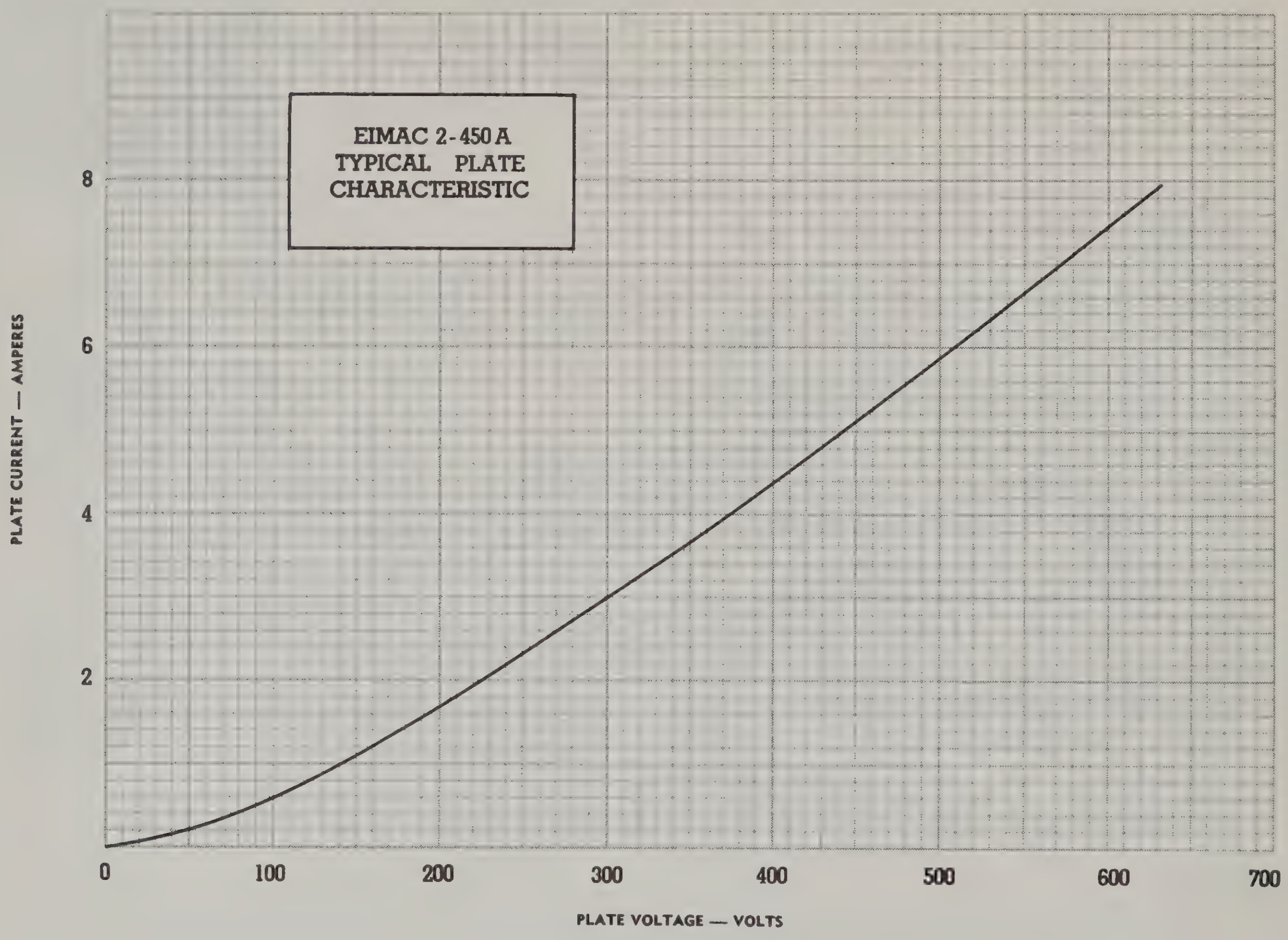
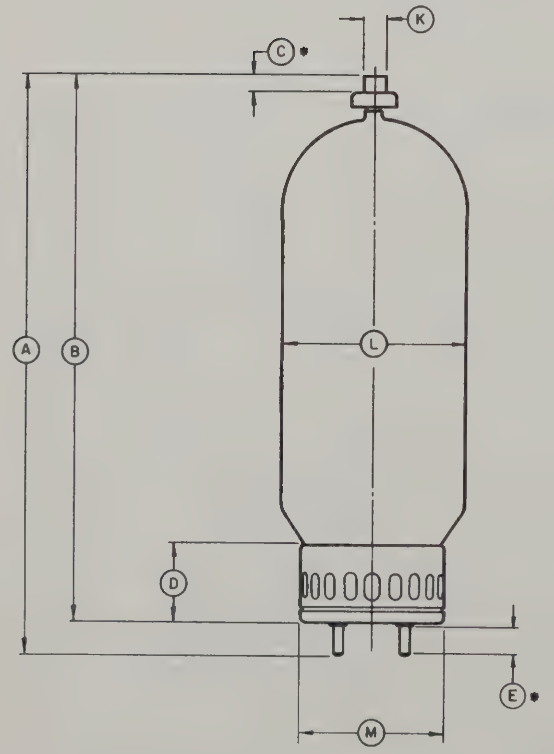
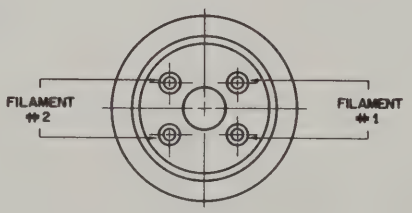
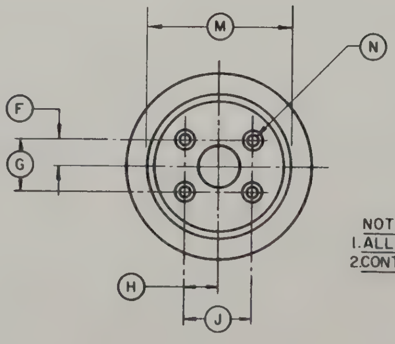
▶ Indicates change from sheet dated 2-13-58







DIMENSION DATA			
REF.	NOM.	MIN.	MAX.
A		13 1/8	14 1/8
B		12 1/4	13 1/4
C		.445	.465
D	1 3/4		
E		.662	.712
F		.610	.640
G		1.235	1.265
H		.829	.859
J		1.672	1.702
K		.554 DIA.	.566 DIA.
L			4 5/8 DIA.
M			3 5/8 DIA.
N		.245 DIA.	.255 DIA.



NOTES:
1. ALL DIMENSIONS IN INCHES.
2. CONTACT SURFACE (*).

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

2-2000A

HIGH-VACUUM RECTIFIER

The Eimac 2-2000A is a high-vacuum diode rectifier intended for use in rectifier units, voltage multipliers, or in special applications, whenever conditions of extreme ambient temperatures, high operating frequency, high peak inverse voltages, or the production of high-frequency transients would prevent the use of gas-filled rectifier tubes.

The 2-2000A has a maximum d-c current rating of 750 milliamperes and a maximum peak inverse voltage rating of 75,000 volts. Cooling is by forced air, convection, and radiation.

A single 2-2000A will deliver 600 milliamperes at 31,500 volts to a capacitor-input filter with 26,500 volts single-phase supply. Four 2-2000A's in a bridge circuit will deliver 1.50 amperes at 47,600 volts to a choke-input filter with 53,000 volts single-phase supply.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten

Voltage	10.0 volts
Current	25.0 amperes

MECHANICAL

Base	Special 4-pin
Basing	Refer to outline drawing
Socket	Refer to discussion under "Application"
Mounting Position	Vertical, base down or up
Cooling	Forced air, convection, and radiation
Maximum Temperature of Plate Seal	225°C
Recommended Heat Dissipating Plate Connector	Eimac HR-8
Maximum Over-all Dimensions:	
Length	17.8 inches
Diameter	8.13 inches
Net Weight	3 pounds
Shipping Weight (approx.)	13 pounds

MAXIMUM RATINGS (Per tube)

PEAK INVERSE PLATE VOLTAGE	75,000 MAX. VOLTS
PLATE DISSIPATION	1200 MAX. WATTS
D-C PLATE CURRENT[1]	750 MAX. MA
PEAK PLATE CURRENT	12 MAX. AMPERES

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[1] Averaged over one cycle for each tube. Applies only when the rectifier is coupled to the load by a choke-input filter incorporating the "critical" value (or larger) of input inductance. For maximum d-c current ratings under this and other load conditions see discussion under "Application".

APPLICATION

MECHANICAL

Mounting—The 2-2000A must be mounted vertically with the base either down or up. The lead to the plate terminal of the tube should be flexible.

The special 4-pin base fits an E. F. Johnson Co. No. 124-214 or an equivalent socket. In some circuits, particularly those of the voltage multipliers illustrated in Fig. 2, it may be necessary to mount the socket on stand-off insulators, or on a sheet of insulating material, to provide adequate insulation to ground.

Cooling—The 2-2000A is cooled by forced air, convection, and radiation. Forced air is required for cooling of the filament seals. If an E. F. Johnson Co. No. 124-214 socket is used, air at a static pressure of 4 inches of water measured at the inlet of the 1/4-inch cooling tube in the socket will provide sufficient base cooling. The base of the tube is provided with a 1-inch diameter hole. If a socket is used with a 1-inch diameter matching hole and the manifold is of the same diameter, a static pressure of less than 0.1 inch of water will be required. Clearance should be provided around the glass envelope adequate

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APPLICATION (Continued)

for the free circulation of air. An Eimac HR-8 heat Dissipating Connector or equivalent is required on the plate terminal.

The maximum temperature at the plate seal must not exceed 225°C. A convenient accessory for measuring this temperature is "Tempilaq", a temperature-sensitive lacquer available from the Tempil Corporation, 132 W. 22nd St, New York 11, N. Y.

ELECTRICAL

Filament Operation—For maximum tube life, the filament voltage, as measured at the base pins, should be the rated value of 10.0 volts. Variations must be kept within the range from 9.5 to 10.5 volts. In applications which require the diode to deliver high peak currents, it is important to maintain the filament voltage at the rated value. All four socket terminals should be used, putting two in parallel for each filament connection.

CAUTION SHOULD BE OBSERVED WHEN MEASURING RECTIFIER FILAMENT VOLTAGE. THE FILAMENT CIRCUIT MAY BE AT HIGH POTENTIAL.

The thoriated-tungsten filament of the 2-2000A reaches operating temperature in a fraction of a second after application of voltage. Plate voltage may be applied simultaneously with filament voltage.

Plate Operation—The plate of the 2-2000A operates at dull red color at the maximum plate dissipation rating of 1200 watts. The maximum peak inverse voltage rating of 75,000 volts should not be exceeded at any time.

Performance—The accompanying table shows some maximum performance capabilities of the 2-2000A when used as a power-supply rectifier.

2-2000A MAXIMUM-PERFORMANCE CAPABILITIES

		Capacitor-Input Filter		Choke-Input Filter	
Circuit Type	A-C Input Voltage (volts rms)	D-C Output Voltage (volts)	D-C Output Current (amperes)	D-C Output Voltage (volts)	D-C Output Current (amperes)
Single-Phase, Half-Wave	26,500	31,500	0.600	. .	.
Single-Phase, Full-Wave	26,500[1]	31,500	1.20	23,800	1.50
Single-Phase, Bridge	53,000	63,000	1.20	47,600	1.50

[1] One-half the transformer secondary voltage.

Maximum D-C Current Ratings—Plate dissipation rather than peak current usually limits the d-c current which the 2-2000A is capable of delivering to the load. Because the plate dissipation associated with a given d-c current depends upon the amount of ripple and its wave-shape, circuit conditions will determine the maximum d-c current rating of the tube.

Choke-Input Filter—The maximum d-c current rating of the 2-2000A is 750 milliamperes when the load incorporates a choke-input filter with the "critical" value (or larger) of input inductance (L_1 in Fig. 1):

$$L_o = \frac{R_{eff}}{18.8f} \quad \text{for full-wave single-phase rectifiers,}$$

$$L_o = \frac{R_{eff}}{75f} \quad \text{for half-wave three-phase rectifiers,}$$

$$L_o = \frac{R_{eff}}{660f} \quad \text{for full-wave three-phase rectifiers,}$$

where: L_o = "critical" value of input inductance (henries),

f = supply-line frequency (cycles per second),

$$R_{eff} = \frac{\text{Load voltage (volts)}}{\text{Load current (amps)}}.$$

Choke-input filters are not normally used with single-phase half-wave rectifiers.

Capacitor-Input Filter—The 2-2000A is particularly suitable for power-supply applications demanding high voltage at low current. Under these conditions capacitor-input filter circuits become desirable. The maximum d-c current rating of the 2-2000A when no input choke is incorporated in the filter depends upon the total series resistance of the capacitor-charging circuit relative to the effective load resistance seen by each tube. The circuit diagrams and tabulation in Fig. 2 are so arranged and labeled that this required series resistance may be found for a wide range of load conditions. This may be done by determining the value of the following quantities:

E_c is the filter-input d-c voltage. While this is usually the entire load voltage, in the case of voltage multipliers it is the load voltage divided by the multiplication factor.

I_p is th d-c current per tube. This is the entire load current only in the case of the simple half-wave rectifier or half- or full-wave multiplier. In the case of full-wave center-tapped or bridge rectifiers, I_p is half the load current.

R_c is the total charging-circuit resistance. A certain minimum value of charging-circuit resistance is necessary to limit the peak value of current to which the tubes will be subjected under given load conditions. This required minimum depends upon the d-c current per tube (I_p), and has been tabulated in Fig. 2 as a percentage of the effective load resistance per tube (E_c/I_p). The total charging-circuit resistance involves the internal resistance of the rectifier tube, R_p, the added series resistor, R_s, and the equivalent internal resistance of the a-c voltage supply, R_i.

R_p is the plate resistance of the 2-2000A, which may be taken as 400 ohms.

R_i is the equivalent internal resistance of the supply. This may be taken as the regulation of the high-voltage supply expressed as a decimal multiplied by the load resistance used in measuring this regulation.

R_s is the series resistor which must be inserted in the charging circuit to bring the total charging-circuit resistance up to the required minimum. Its value may be found from the formula associated with each of the circuits of Fig. 2. This resistor must be inserted in such a position in the circuit that it protects all tubes.

Tubes may be operated in parallel to increase the output capability in a given circuit. When two tubes are placed in parallel at each place where one is shown in the circuits of Fig. 2, the plate resistance (R_p) will be half as great and the maximum allowable load current twice as great as indicated.

Peak Inverse Voltage—The peak inverse voltage rating of the 2-2000A is 75,000 volts. In single-phase power supply rectifier circuits the peak inverse voltage to be used in design is the peak a-c supply voltage (1.41 times E_{rms} in Fig. 2) in the case of bridge circuits, and twice this value in the case of half- and full-wave rectifiers and voltage multipliers. Peak inverse voltage in three-phase operation depends upon the circuit employed, and will be found listed in the handbooks.

Special Applications— The ratings given for capacitor-input filter circuits assume values of input capacitance large enough to hold the ripple to a low value. In special applications where a larger percent ripple is tolerable, and filter capacitance is low, the 2-2000A is capable of larger d-c output currents.

As a unidirectional conductor in d-c circuits where the current is continuous and the percent ripple is moderate, the maximum current rating of the 2-2000A is 1500 milliamperes.

The plate characteristic curve for the 2-2000A serves as a guide to special applications. The maximum plate dissipation rating of 1200 watts, the maximum peak inverse voltage rating of 75,000 volts, and the maximum peak plate current of 12 amperes must not be exceeded.

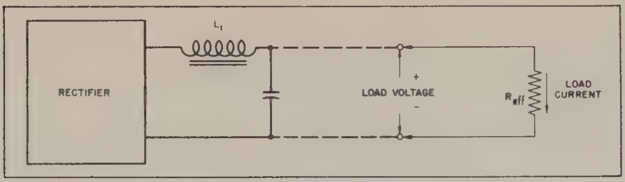
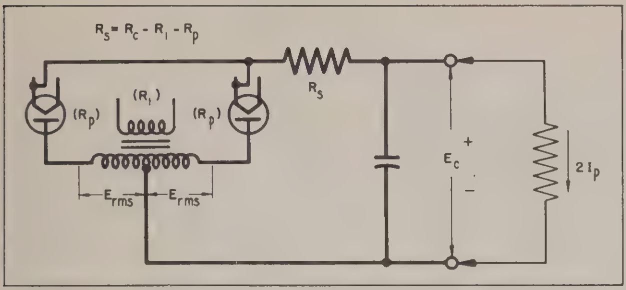
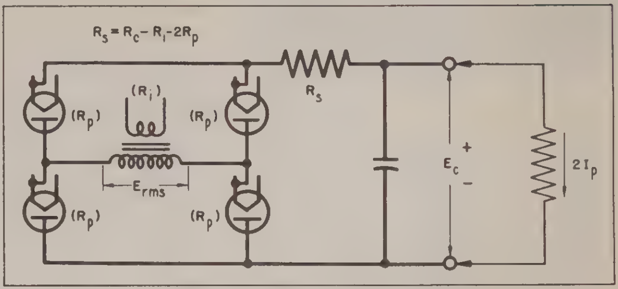


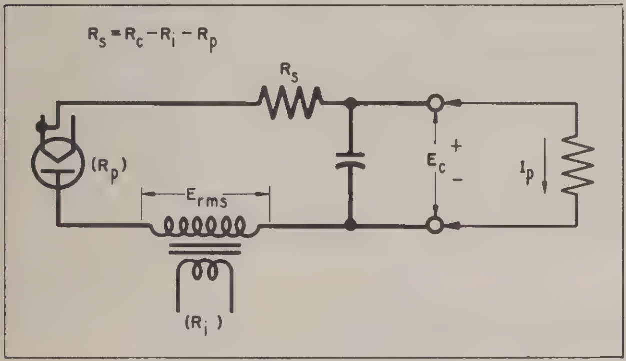
Fig. 1. Rectifier with Choke-Input Filter



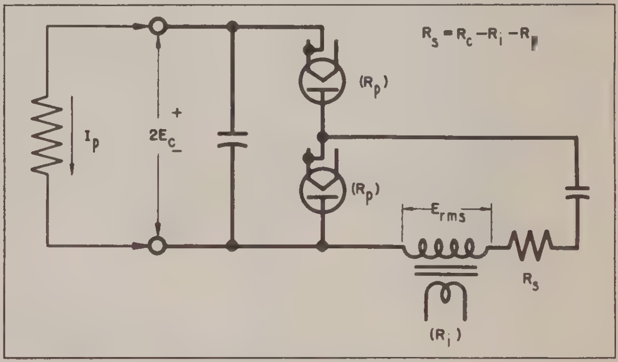
a. Full-Wave Center-Tapped Rectifier



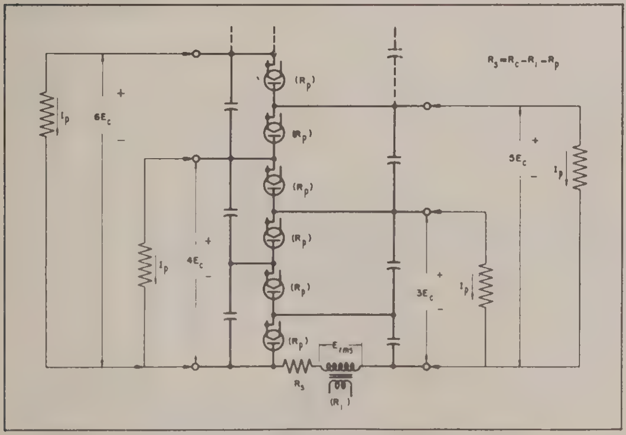
b. Full-Wave Bridge Rectifier



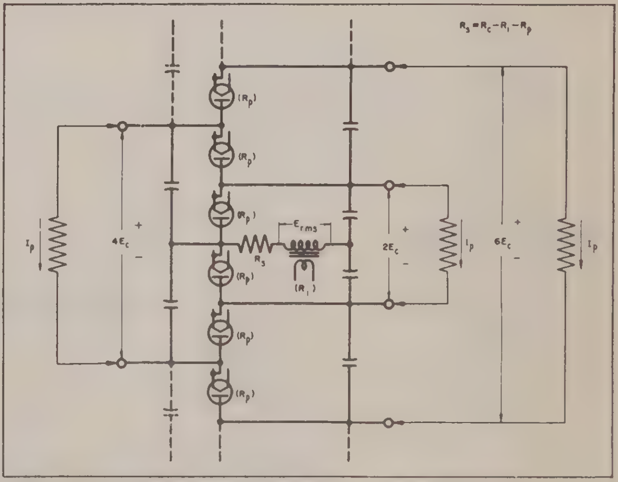
c. Half-Wave Rectifier



d. Half-Wave Voltage Doubler



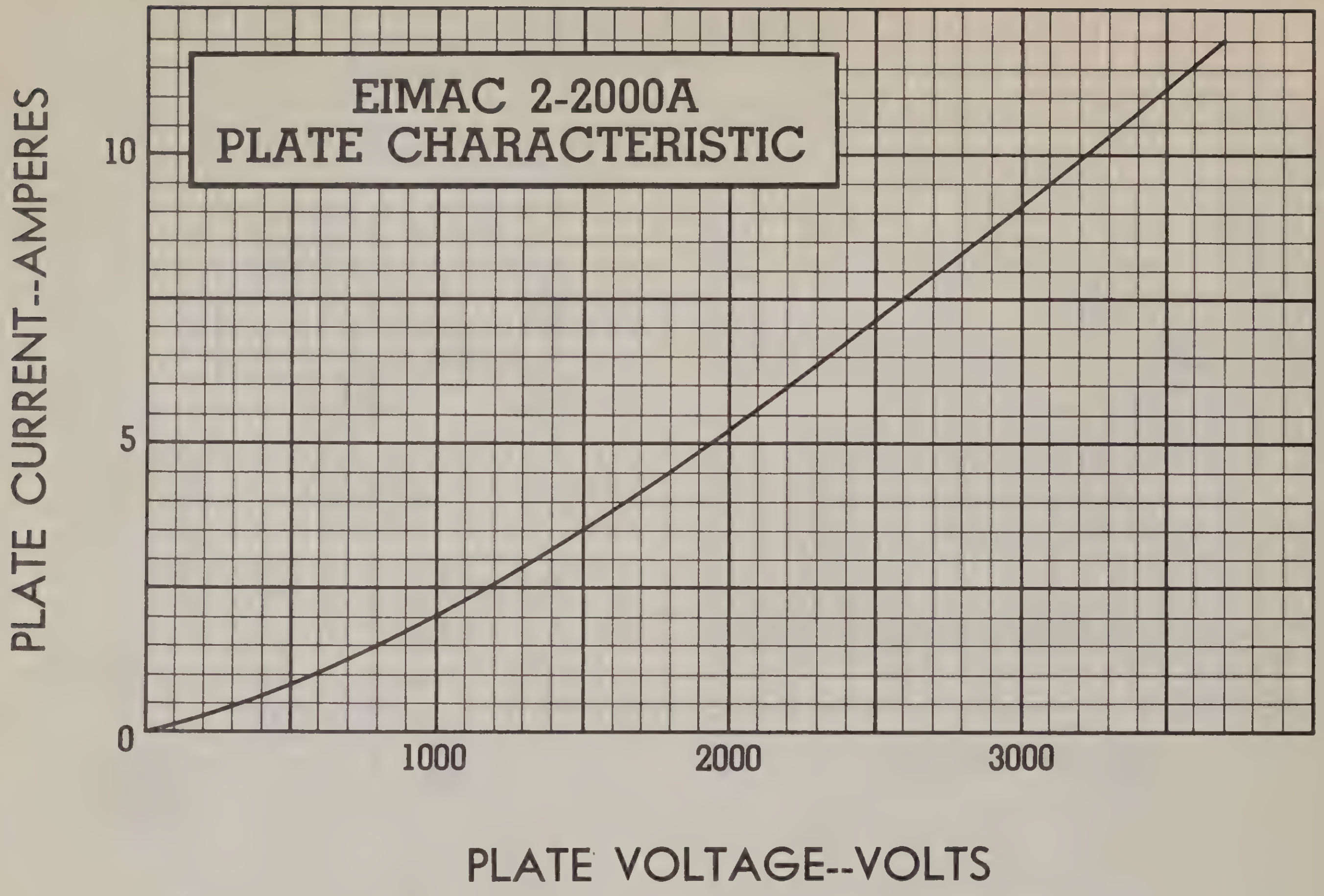
e. Half-Wave Voltage Multiplier (with common ground when R_s is inserted on the "high" side of E_{rms})

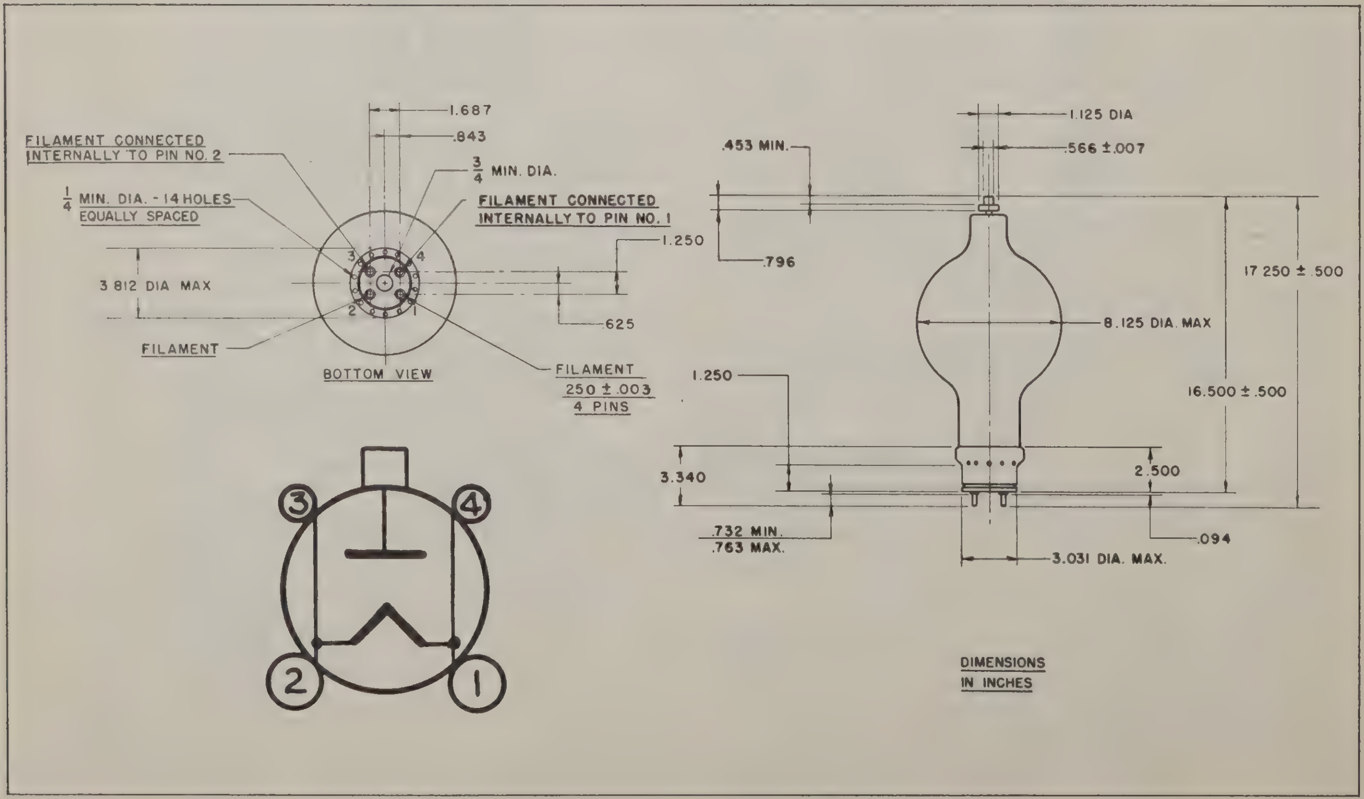


f. Full-Wave Voltage Multiplier

Eimac 2-2000A Maximum D-C Current Ratings for R-C Filter Applications						
D-C Plate Current (I_p)	550	600	650	700	750	milliamperes per tube
Total Charging-Circuit Resistance (R_c)	1.1	2.1	3.8	7.0	13	percent of Effective Load Resistance per Tube (E_c/I_p)
A-C Supply Voltage (E_{rms})	0.80	0.84	0.90	1.00	1.16	times Filter-Input D-C Voltage (E_c)
Peak Inverse Voltage (½ these values for circuit b.)	2.3	2.4	2.6	2.8	3.3	times Filter-Input D-C Voltage (E_c)

Fig. 2 Eimac 2-2000A basic R-C Circuits (for any one of the indicated loads)
R_i = Equivalent resistance of voltage source
R_p = 400 ohms (200 ohms for two tubes in parallel)





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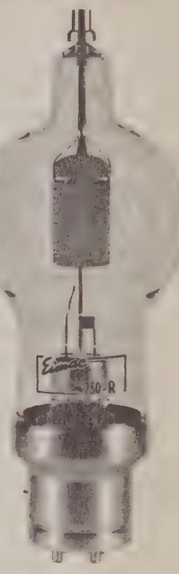
EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

250R

HIGH-VACUUM RECTIFIER



The Eimac 250R is a high-vacuum diode rectifier intended for use in rectifier units, voltage multipliers, or in special applications, whenever conditions of extreme ambient temperatures, high operating frequency, high peak inverse voltages, or the production of high-frequency transients would prevent the use of gas-filled rectifier tubes.

The 250R has a maximum d-c current rating of 250 milliamperes and a maximum peak inverse voltage rating of 60,000 volts. Cooling is by convection and radiation.

A single 250R will deliver 160 milliamperes at 24,000 volts to a capacitor-input filter with 21,000 volts single-phase supply. Four 250R's in a bridge circuit will deliver 500 milliamperes at 38,000 volts to a choke-input filter with 42,000 volts single-phase supply.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten	
Voltage	5.0 volts
Current	10.5 amperes

MECHANICAL

Base	50-watt jumbo 4-pin bayonet
Basing	Refer to outline drawing
Socket	Refer to discussion under "Application"
Mounting Position	Vertical, base down or up
Cooling	Convection and Radiation
Maximum Temperature of Plate Seal	225°C
Recommended Heat Dissipating Plate Connector	Eimac HR-6
Maximum Over-all Dimensions:	
Length	10.13 inches
Diameter	3.82 inches
Net Weight	10 ounces
Shipping Weight (approx.)	3 pounds

MAXIMUM RATINGS (Per tube)

PEAK INVERSE PLATE VOLTAGE	60,000 MAX. VOLTS
PLATE DISSIPATION	150 MAX. WATTS
D-C PLATE CURRENT[1]	250 MAX. MA
PEAK PLATE CURRENT	2.5 MAX. AMPERES

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[1] Averaged over one cycle for each tube. Applies only when the rectifier is coupled to the load by a choke-input filter incorporating the "critical" value (or larger) of input inductance. For maximum d-c current ratings under this and other load conditions see discussion under "Application".

APPLICATION

MECHANICAL

Mounting—The 250R must be mounted vertically with the base either down or up. The lead to the plate terminal of the tube should be flexible.

The 50-watt jumbo 4-pin bayonet base fits an E. F. Johnson Co. No. 123-211, a National Co. No. XM-50, or an equivalent socket. In some circuits, particularly those of the voltage multipliers illustrated in Fig. 2, it may be necessary to mount the socket on stand-off insulators, or on a sheet of insulating material, to provide adequate insulation to ground.

Cooling—The 250R is cooled by convection and radiation. Clearance should be provided around the glass envelope adequate for the free circulation of air. An Eimac HR-6 Heat Dissipating Connector or equivalent is required on the plate terminal.

The maximum temperature at the plate seal must not exceed

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APPLICATION (Continued)

225°C. A convenient accessory for measuring this temperature is "Tempilaq", a temperature-sensitive lacquer available from the Tempil Corporation, 132 W. 22nd St., New York 11, N. Y.

ELECTRICAL

Filament Operation—For maximum tube life, the filament voltage, as measured at the base pins, should be the rated value of 5.0 volts. Variations must be kept within the range from 4.75 to 5.25 volts. In applications which require the diode to deliver high peak currents, it is important to maintain the filament voltage at the rated value.

> CAUTION SHOULD BE OBSERVED WHEN MEASURING RECTIFIER FILAMENT VOLTAGE. THE FILAMENT CIRCUIT MAY BE AT HIGH POTENTIAL.

The thoriated-tungsten filament of the 250R reaches operating temperature in a fraction of a second after application of voltage. Plate voltage may be applied simultaneously with filament voltage.

Plate Operation—With low room illumination, the plate of the 250R begins to show color as the maximum plate dissipation rating of 150 watts is approached. The maximum peak inverse voltage rating of 60,000 volts should not be exceeded at any time.

Performance—The accompanying table shows some maximum performance capabilities of the 250R when used as a power-supply rectifier.

250R MAXIMUM-PERFORMANCE CAPABILITIES

		Capacitor-Input Filter		Choke-Input Filter	
Circuit Type	A-C Input Voltage (volts rms)	D-C Output Voltage (volts)	D-C Output Current (ma)	D-C Output Voltage (volts)	D-C Output Current (ma)
Single-Phase, Half-Wave	21,000	24,000	160	....	. .
Single-Phase, Full-Wave	21,000[1]	24,000	320	19,000	500
Single-Phase, Bridge	42,000	48,000	320	38,000	500

[1] One-half the transformer secondary voltage.

Maximum D-C Current Ratings—Plate dissipation rather than peak current usually limits the d-c current which the 250R is capable of delivering to the load. Because the plate dissipation associated with a given d-c current depends upon the amount of ripple and its wave-shape, circuit conditions will determine the maximum d-c current rating of the tube.

Choke-Input Filter—The maximum d-c current rating of the 250R is 250 milliamperes when the load incorporates a choke-input filter with the "critical" value (or larger) of input inductance (L_1 in Fig. 1):

$$L_o = \frac{R_{eff}}{18.8f} \quad \text{for full-wave single-phase rectifiers,}$$

$$L_o = \frac{R_{eff}}{75f} \quad \text{for half-wave three-phase rectifiers,}$$

$$L_o = \frac{R_{eff}}{660f} \quad \text{for full-wave three-phase rectifiers,}$$

where: L_o = "critical" value of input inductance (henries),
f = supply-line frequency (cycles per second),

$$R_{eff} = \frac{\text{Load voltage (volts)}}{\text{Load current (amps)}}.$$

Choke-input filters are not normally used with single-phase half-wave rectifiers.

Capacitor-Input Filter—The 250R is particularly suitable for power-supply applications demanding high voltage at low current. Under these conditions capacitor-input filter circuits become desirable. The maximum d-c current rating of the 250R when no input choke is incorporated in the filter depends upon the total series resistance of the capacitor-charging circuit relative to the effective load resistance seen by each tube. The circuit diagrams and tabulation in Fig. 2 are so arranged and labeled that this required series resistance may be found for a wide range of load conditions. This may be done by determining the value of the following quantities:

E_c is the filter-input d-c voltage. While this is usually the entire load voltage, in the case of voltage multipliers it is the load voltage divided by the multiplication factor.

I_p is the d-c current per tube. This is the entire load current only in the case of the simple half-wave rectifier or half- or full-wave multiplier. In the case of full-wave center-tapped or bridge rectifiers, I_p is half the load current.

R_c is the total charging-circuit resistance. A certain minimum value of charging-circuit resistance is necessary to limit the peak value of current to which the tubes will be subjected under given load conditions. This required minimum depends upon the d-c current per tube (I_p), and has been tabulated in Fig. 2 as a percentage of the effective load resistance per tube (E_c/I_p). The total charging-circuit resistance involves the internal resistance of the rectifier tube, R_p, the added series resistor, R_s, and the equivalent internal resistance of the a-c voltage supply, R_i.

R_p is the plate resistance of the 250R, which may be taken as 750 ohms.

R_i is the equivalent internal resistance of the supply. This may be taken as the regulation of the high-voltage supply experssed as a decimal multiplied by the load resistance used in measuring this regulation.

R_s is the series resistor which must be inserted in the charging circuit to bring the total charging-circuit resistance up to the required minimum. Its value may be found from the formula associated with each of the circuits of Fig. 2. This resistor must be inserted in such a position in the circuit that it protects all tubes.

Tubes may be operated in parallel to increase the output capability in a given circuit. When two tubes are placed in parallel at each place where one is shown in the circuits of Fig. 2, the plate resistance (R_p) will be half as great and the maximum allowable load current twice as great as indicated.

Peak Inverse Voltage—The peak inverse voltage rating of the 250R is 60,000 volts. In single-phase power-supply rectifier circuits the peak inverse voltage to be used in design is the peak a-c supply voltage (1.41 times E_{rms} in Fig. 2) in the case of bridge circuits, and twice this value in the case of half- and full-wave rectifiers and voltage multipliers. Peak inverse voltage in three-phase operation depends upon the circuit employed, and will be found listed in the handbooks.

Special Applications—The ratings given for capacitor-input filter circuits assume values of input capacitance large enough to hold the ripple to a low value. In special applications where a larger percent ripple is tolerable, and filter capacitance is low, the 250R is capable of larger d-c output currents.

As a unidirectional conductor in d-c circuits where the current is continuous and the percent ripple is moderate, the maximum current rating of the 250R is 400 milliamperes.

The plate characteristic curve for the 250R serves as a guide to special applications. The maximum plate dissipation rating of 150 watts, the maximum peak inverse voltage rating of 60,000 volts, and the maximum peak plate current of 2.5 amperes must not be exceeded.

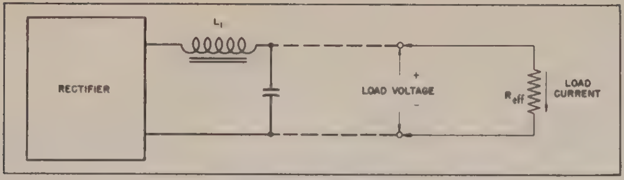
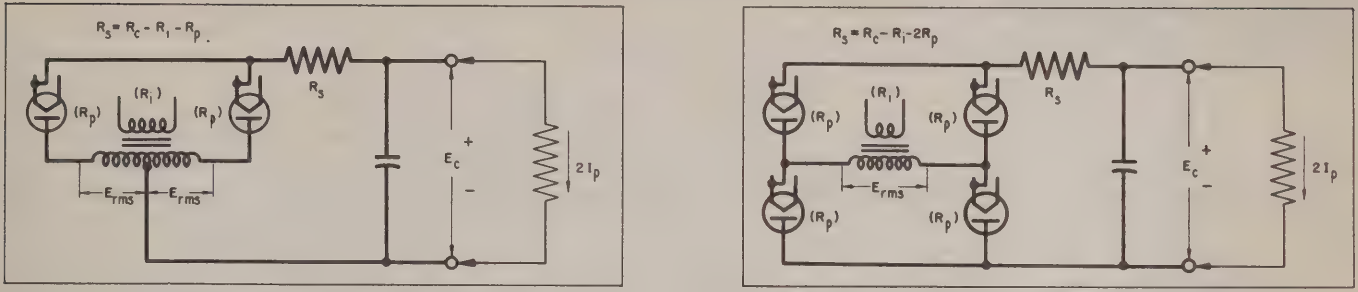
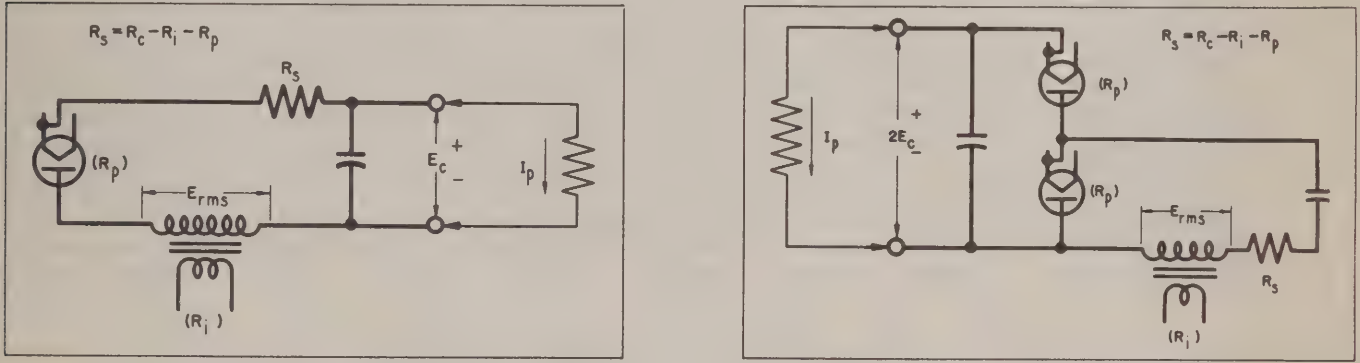


Fig. 1. Rectifier with Choke-Input Filter



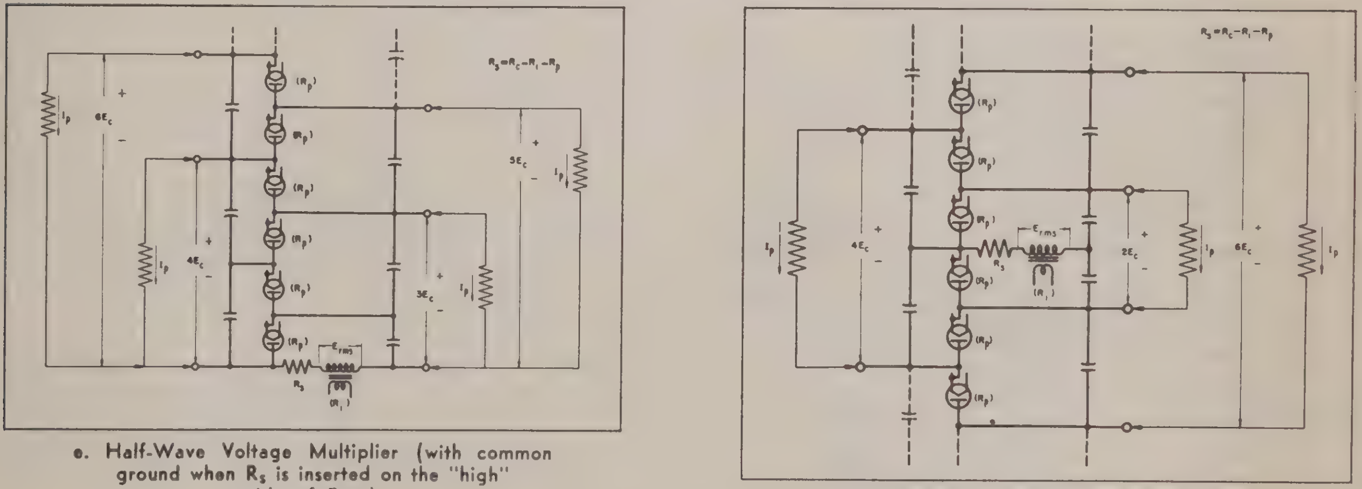
a. Full-Wave Center-Tapped Rectifier

b. Full-Wave Bridge Rectifier



c. Half-Wave Rectifier

d. Half-Wave Voltage Doubler

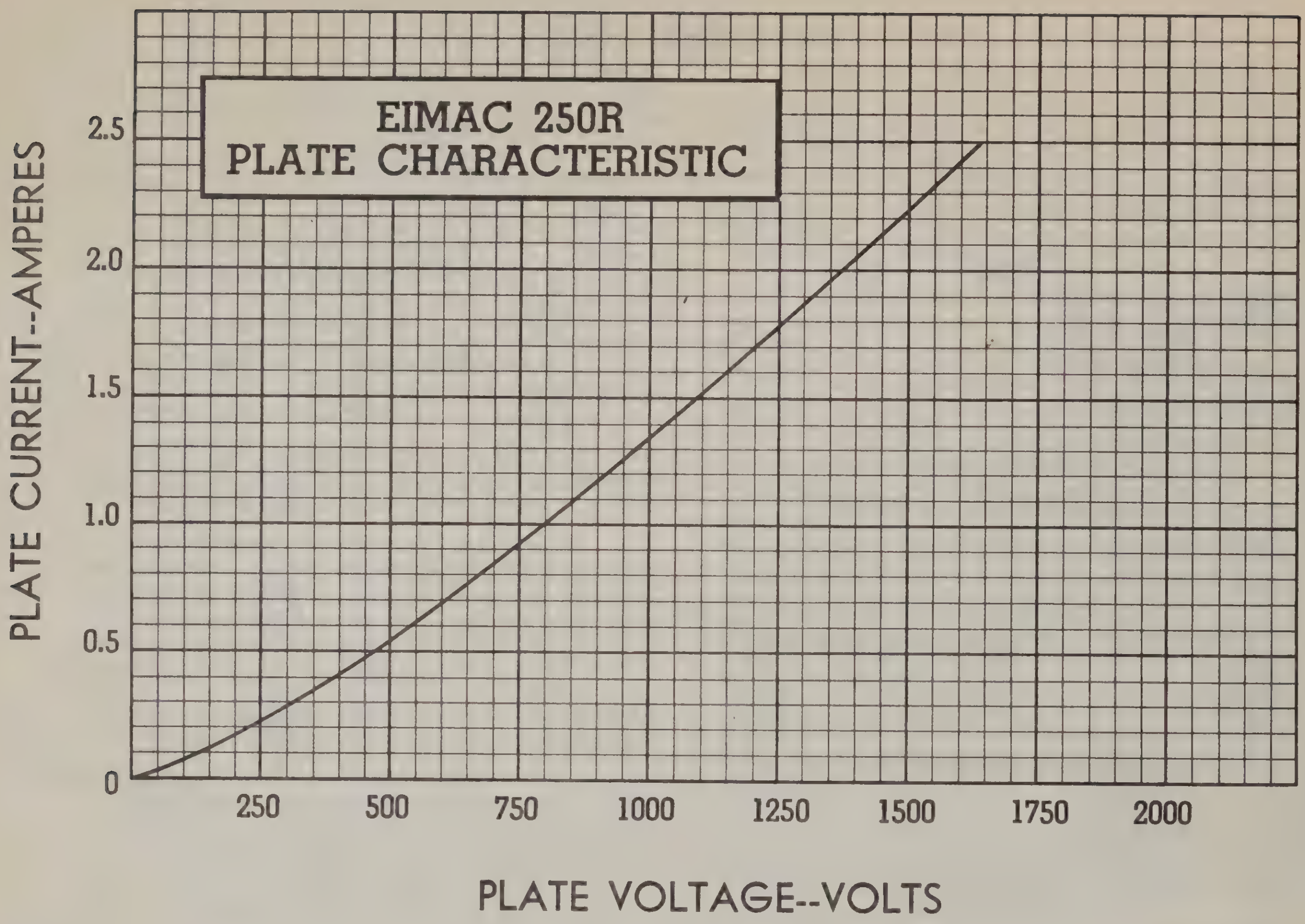


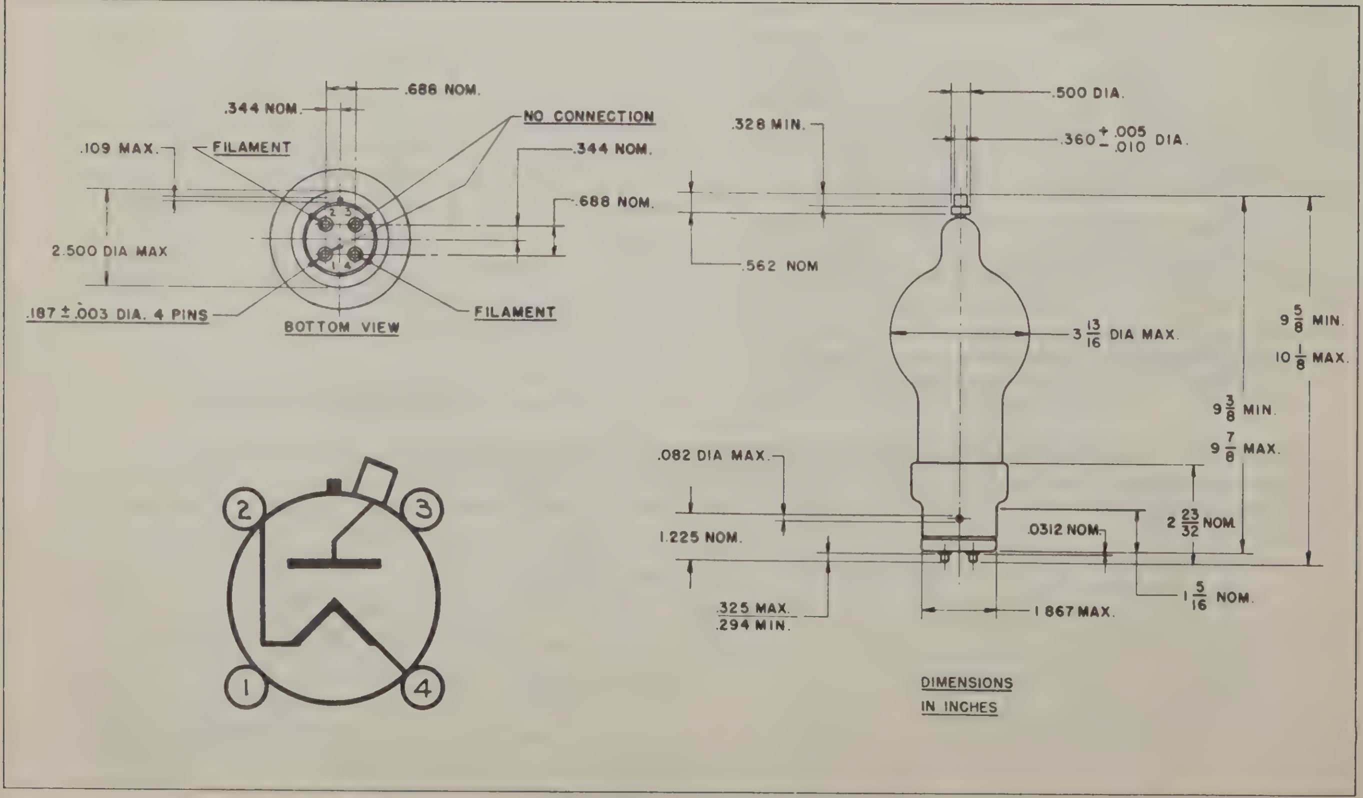
e. Half-Wave Voltage Multiplier (with common ground when R_s is inserted on the "high" side of E_{rms})

f. Full-Wave Voltage Multiplier

Eimac 250R Maximum D-C Current Ratings for R-C Filter Applications								
D-C Plate Current (I_p)	140	150	160	170	180	190	200	milliamperes per tube
Total Charging-Circuit Resistance (R_c)	1.2	1.9	3.0	4.8	7.6	12	19	percent of Effective Load Resistance per Tube (E_c/I_p)
A-C Supply Voltage (E_{rms})	0.80	0.83	0.87	0.93	1.01	1.14	1.33	times Filter-Input D-C Voltage (E_c)
Peak Inverse Voltage (1/2 these values for circuit b.)	2.3	2.4	2.5	2.7	2.9	3.2	3.7	times Filter-Input D-C Voltage (E_c)

Fig. 2 Eimac 250R Basic R-C Circuits (for any one of the indicated loads)
R_i = Equivalent resistance of voltage source
R_p = 750 ohms (375 ohms for two tubes in parallel)





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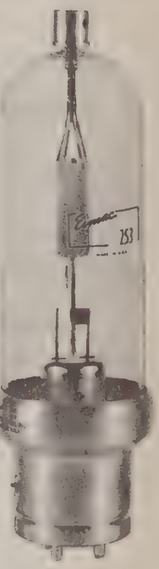
EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

253
HIGH-VACUUM RECTIFIER



The Eimac 253 is a high-vacuum diode rectifier intended for use in rectifier units, voltage multipliers, or in special applications, whenever conditions of extreme ambient temperatures, high operating frequency, high peak inverse voltages, or the production of high-frequency transients would prevent the use of gas-filled rectifier tubes.

The 253 has a maximum d-c current rating of 350 milliamperes and a maximum peak inverse voltage rating of 15,000 volts. Cooling is by convection and radiation.

A single 253 will deliver 210 milliamperes at 5640 volts to a capacitor-input filter with 5300 volts single-phase supply. Four 253's in a bridge circuit will deliver 700 milliamperes at 9500 volts to a choke-input filter with 10,600 volts single-phase supply.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten

Voltage	5.0 volts
Current	10.0 amperes

MECHANICAL

Base	50-watt jumbo 4-pin bayonet
Basing	Refer to outline drawing
Socket	Refer to discussion under "Application"
Mounting Position	Vertical, base down or up
Cooling	Convection and Radiation
Maximum Temperature of Plate Seal	225°C
Recommended Heat Dissipating Plate Connector	Eimac HR-8
Maximum Over-all Dimensions:	
Length	8.75 inches
Diameter	2.50 inches
Net Weight	7 ounces
Shipping Weight (approx.)	1 pound

MAXIMUM RATINGS (Per Tube)

PEAK INVERSE PLATE VOLTAGE	15,000 MAX. VOLTS
PLATE DISSIPATION	100 MAX. WATTS
D-C PLATE CURRENT[1]	350 MAX. MA
PEAK PLATE CURRENT	2.5 MAX. AMPERES

[1] Averaged over one cycle for each tube. Applies only when the rectifier is coupled to the load by a choke-input filter incorporating the "critical" value (or larger) of input inductance. For maximum d-c current ratings under this and other load conditions see discussion under "Application".

APPLICATION

MECHANICAL

Mounting—The 253 must be mounted vertically with the base either down or up. The lead to the plate terminal of the tube should be flexible.

The 50-watt jumbo 4-pin bayonet base fits an E. F. Johnson Co. No. 123-211, a National Co. No. XM-50, or an equivalent socket. In some circuits, particularly those of the voltage multipliers illustrated in Fig. 2, it may be necessary to mount the socket on stand-off insulators, or on a sheet of insulating material, to provide adequate insulation to ground.

Cooling—The 253 is cooled by convection and radiation. Clearance should be provided around the glass envelope adequate for the free circulation of air. An Eimac HR-8 Heat Dissipating Connector or equivalent is required on the plate terminal.

The maximum temperature at the plate seal must not exceed 225°C. A convenient accessory for measuring this tem-

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perature is "Tempilaq", a temperature-sensitive lacquer available from the Tempil Corporation, 132 W. 22nd Street, New York 11, N. Y.

ELECTRICAL

Filament Operation—For maximum tube life, the filament voltage, as measured at the base pins, should be the rated value of 5.0 volts. Variations must be kept within the range from 4.75 to 5.25 volts. In applications which require the diode to deliver high peak currents, it is important to maintain the filament voltage at the rated value.

CAUTION SHOULD BE OBSERVED WHEN MEASURING RECTIFIER FILAMENT VOLTAGE. THE FILAMENT CIRCUIT MAY BE AT HIGH POTENTIAL.

The thoriated-tungsten filament of the 253 reaches operating temperature in a fraction of a second after application of voltage. Plate voltage may be applied simultaneously with filament voltage.

Plate Operation—With low room illumination, the plate of the 253 begins to show color as the maximum plate dissipation rating of 100 watts is approached. The maximum peak inverse voltage rating of 15,000 volts should not be exceeded at any time.

Performance—The accompanying table shows some maximum performance capabilities of the 253 when used as a power-supply rectifier.

253 MAXIMUM-PERFORMANCE CAPABILITIES

		Capacitor-Input Filter		Choke-Input Filter	
Circuit Type	A-C Input Voltage (volts rms)	D-C Output Voltage (volts)	D-C Output Current (ma)	D-C Output Voltage (volts)	D-C Output Current (ma)
Single-Phase, Half-Wave	5300	5640	210	....	....
Single-Phase, Full-Wave	5300[1]	5640	420	4750	700
Single-Phase, Bridge	10,600	11,280	420	9500	700

[1] One-half the transformer secondary voltage.

Maximum D-C Current Ratings—Plate dissipation rather than peak current usually limits the d-c current which the 253 is capable of delivering to the load. Because the plate dissipation associated with a given d-c current depends upon the amount of ripple and its wave-shape, circuit conditions will determine the maximum d-c current rating of the tube.

Choke-Input Filter—The maximum d-c current rating of the 253 is 350 milliamperes when the load incorporates a choke-input filter with the "critical" value (or larger) of input inductance (L_1 in Fig. 1):

$$L_o = \frac{R_{eff}}{18.8f} \quad \text{for full-wave single-phase rectifiers,}$$

$$L_o = \frac{R_{eff}}{75f} \quad \text{for half-wave three-phase rectifiers,}$$

$$L_o = \frac{R_{eff}}{660f} \quad \text{for full-wave three-phase rectifiers,}$$

where: L_o = "critical" value of input inductance (henries),
f = supply-line frequency (cycles per second),

$$R_{eff} = \frac{\text{Load voltage (volts)}}{\text{Load current (amps)}}.$$

Choke-input filters are not normally used with single-phase half-wave rectifiers.

Capacitor-Input Filter—The 253 is particularly suitable for power-supply applications demanding high voltage at low current. Under these conditions capacitor-input filter circuits become desirable. The maximum d-c current rating of the 253 when no input choke is incorporated in the filter depends upon the total series resistance of the capacitor-charging circuit relative to the effective load resistance seen by each tube. The circuit diagrams and tabulation in Fig. 2 are so arranged and labeled that this required series resistance may be found for a wide range of load conditions. This may be done by determining the value of the following quantities:

E_c is the filter-input d-c voltage. While this is usually the entire load voltage, in the case of voltage multipliers it is the load voltage divided by the multiplication factor.

I_p is the d-c current per tube. This is the entire load current only in the case of the simple half-wave rectifier or half- or full-wave multiplier. In the case of full-wave center-tapped or bridge rectifiers, I_p is half the load current.

R_c is the total charging-circuit resistance. A certain minimum value of charging-circuit resistance is necessary to limit the peak value of current to which the tubes will be subjected under given load conditions. This required minimum depends upon the d-c current per tube (I_p), and has been tabulated in Fig. 2 as a percentage of the effective load resistance per tube (E_c/I_p). The total charging-circuit resistance involves the internal resistance of the rectifier tube, R_p, the added series resistor, R_s, and the equivalent internal resistance of the a-c voltage supply, R_i.

R_p is the plate resistance of the 253, which may be taken as 300 ohms.

R_i is the equivalent internal resistance of the supply. This may be taken as the regulation of the high-voltage supply expressed as a decimal multiplied by the load resistance used in measuring this regulation.

R_s is the series resistor which must be inserted in the charging circuit to bring the total charging-circuit resistance up to the required minimum. Its value may be found from the formula associated with each of the circuits of Fig. 2. This resistor must be inserted in such a position in the circuit that it protects all tubes.

Tubes may be operated in parallel to increase the output capability in a given circuit. When two tubes are placed in parallel at each place where one is shown in the circuits of Fig. 2, the plate resistance (R_p) will be half as great and the maximum allowable load current twice as great as indicated.

Peak Inverse Voltage—The peak inverse voltage rating of the 253 is 15,000 volts. In single-phase power-supply rectifier circuits the peak inverse voltage to be used in design is the peak a-c supply voltage (1.41 times E_{rms} in Fig. 2) in the case of bridge circuits, and twice this value in the case of half- and full-wave rectifiers and voltage multipliers. Peak inverse voltage in three-phase operation depends upon the circuit employed, and will be found listed in the handbooks.

Special Applications—The ratings given for capacitor-input filter circuits assume values of input capacitance large enough to hold the ripple to a low value. In special applications where a larger percent ripple is tolerable, and filter capacitance is low, the 253 is capable of larger d-c output currents.

As a unidirectional conductor in d-c circuits where the current is continuous and the percent ripple is moderate, the maximum current rating of the 253 is 500 milliamperes.

The plate characteristic curve for the 253 serves as a guide to special applications. The maximum plate dissipation rating of 100 watts, the maximum peak inverse voltage rating of 15,000 volts, and the maximum peak plate current of 2.5 amperes must not be exceeded.

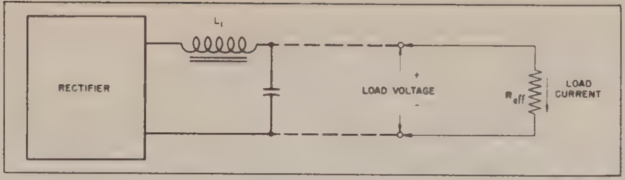
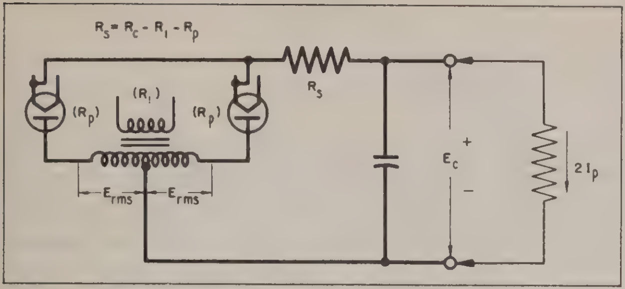
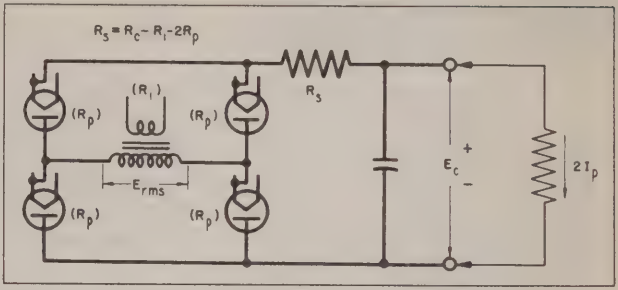


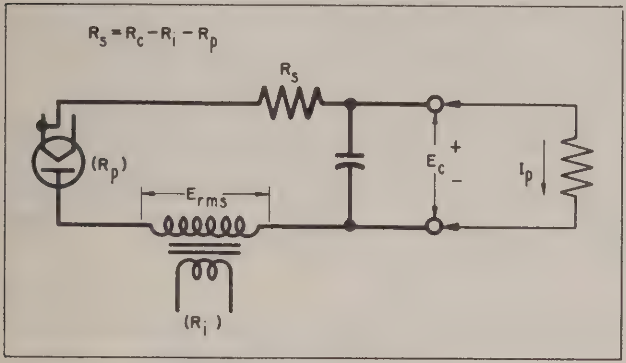
Fig. 1. Rectifier with Choke-Input Filter



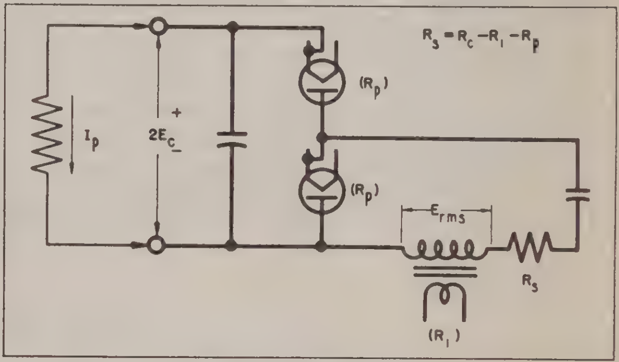
a. Full-Wave Center-Tapped Rectifier



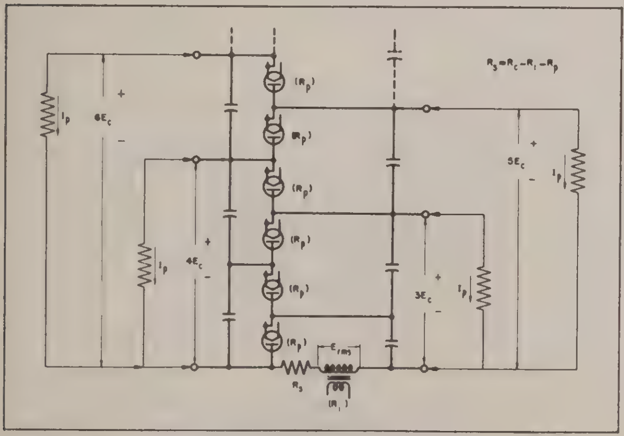
b. Full-Wave Bridge Rectifier



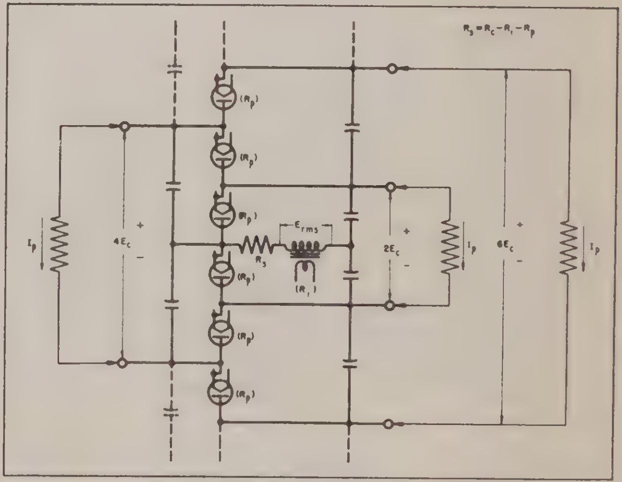
c. Half-Wave Rectifier



d. Half-Wave Voltage Doubler



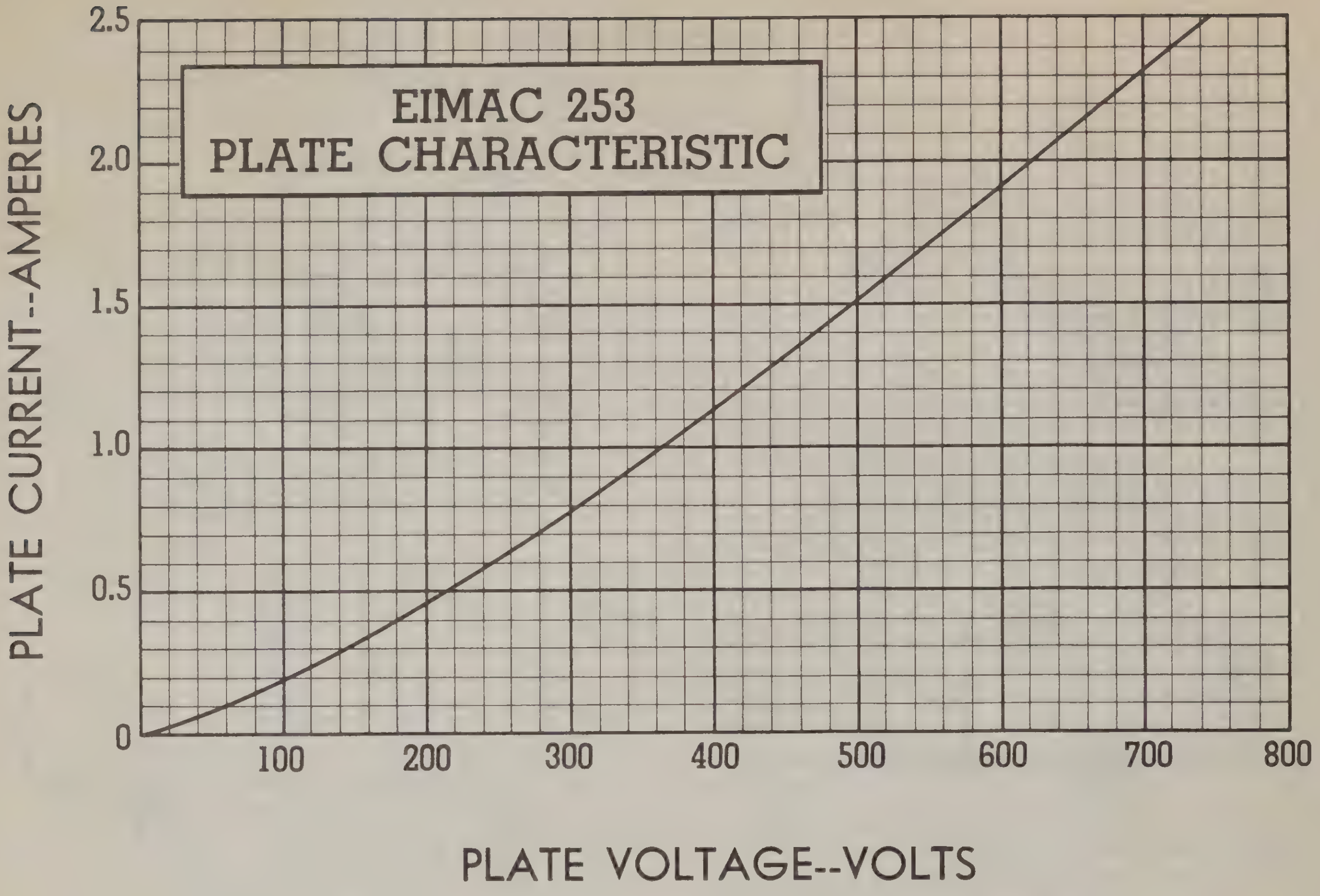
e. Half-Wave Voltage Multiplier (with common ground when R_s is inserted on the "high" side of E_{rms})

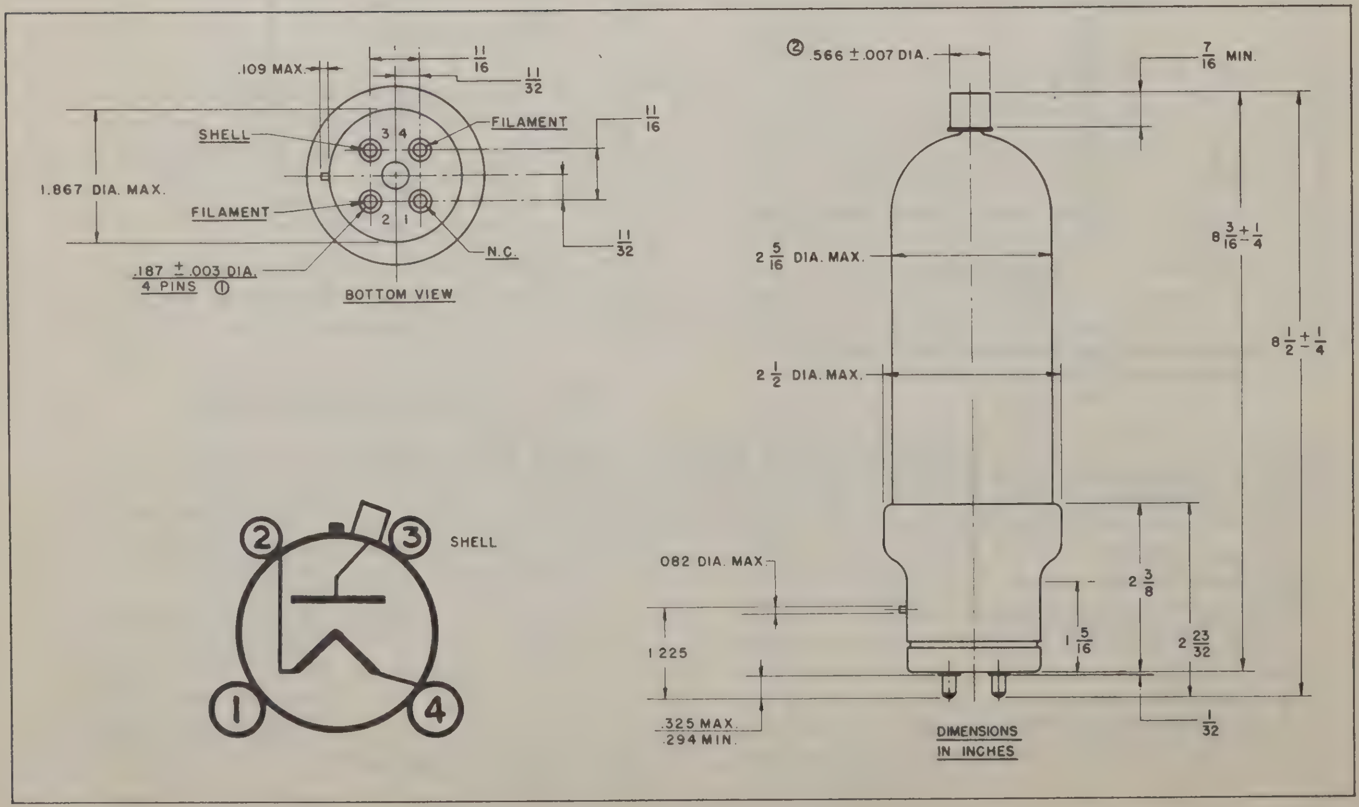


f. Full-Wave Voltage Multiplier

Eimac 253 Maximum D-C Current Ratings for R-C Filter Applications						
D-C Plate Current (I_p)	170	190	210	230	250	milliamperes per tube
Total Charging-Circuit Resistance (R_c)	1.1	2.3	5.0	10	27	percent of Effective Load Resistance per Tube (E_c/I_p)
A-C Supply Voltage (E_{rms})	0.80	0.85	0.94	1.08	1.50	times Filter-Input D-C Voltage (E_c)
Peak Inverse Voltage (½ these values for circuit b.)	2.3	2.4	2.7	3.1	4.3	times Filter-Input D-C Voltage (E_c)

Fig. 2 Eimac 253 Basic R-C Circuits (for any one of the indicated loads)
R_i = Equivalent resistance of voltage source
R_p = 300 ohms (150 ohms for two tubes in parallel)





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EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

8020

(100R)

HIGH-VACUUM RECTIFIER

The Eimac 8020(100R) diode is a high-vacuum rectifier intended for use in rectifier units, voltage multipliers, or in special applications, whenever conditions of extreme ambient temperatures, high operating frequency, high peak inverse voltages, or the production of high-frequency transients would prevent the use of gas-filled rectifier tubes.

The 8020 has a maximum d-c current rating of 100 milliamperes and a maximum peak inverse voltage rating of 40,000 volts. Cooling is by convection and radiation.

A single 8020 will deliver 80 milliamperes at 17,000 volts to a capacitor-input filter with 14,000 volts single-phase supply. Four 8020's in a bridge circuit will deliver 200 milliamperes at 25,000 volts to a choke-input filter with 28,000 volts single-phase supply.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten

Voltage	5.0	volts
Current	6.5	amperes

MECHANICAL

Base	Medium 4-pin bayonet
Basing	Refer to outline drawing
Socket	Refer to discussion under "Application"
Mounting Position	Vertical, base down or up
Cooling	Convection and radiation
Maximum Temperature of Plate Seal	225°C
Recommended Heat Dissipating Plate Connector	Eimac HR-8
Maximum Overall Dimensions:	
Length	8.00 inches
Diameter	2.32 inches
Net Weight	4 ounces
Shipping Weight (approx.)	1 pound

MAXIMUM RATINGS (Per tube)

PEAK INVERSE PLATE VOLTAGE	40,000	MAX. VOLTS
PLATE DISSIPATION	60	MAX. WATTS
D-C PLATE CURRENT[1]	100	MAX. MA
PEAK PLATE CURRENT	1.5	MAX. AMPERE

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[1] Averaged over one cycle for each tube. Applies only when the rectifier is coupled to the load by a choke-input filter incorporating the "critical" value (or larger) of input inductance. For maximum d-c current ratings under this and other load conditions see discussion under "Application".

APPLICATION

MECHANICAL

Mounting—The 8020 must be mounted vertically with the base either down or up. The lead to the plate terminal of the tube should be flexible.

The medium 4-pin bayonet base fits an E. F. Johnson Co. No. 122-224, a National Co. No. XC-4 or CIR-4, or an equivalent socket. In some circuits, particularly those of the voltage multipliers illustrated in Fig. 2, it may be necessary to mount the socket on stand-off insulators, or on a sheet of insulating material, to provide adequate insulation to ground.

Cooling—The 8020 is cooled by convection and radiation. Clearance should be provided around the glass envelope adequate for the free circulation of air. An Eimac HR-8

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APPLICATION (Continued)

Heat Dissipating Connector or equivalent is required on the plate terminal.

The maximum temperature at the plate seal must not exceed 225°C. A convenient accessory for measuring this temperature is "Tempilaq", a temperature-sensitive lacquer available from the Tempil Corporation, 132 W. 22nd St., New York 11, N. Y.

ELECTRICAL

Filament Operation—For maximum tube life, the filament voltage, as measured at the base pins, should be the rated value of 5.0 volts. Variations must be kept within the range from 4.75 to 5.25 volts. In applications which require the diode to deliver high peak currents, it is important to maintain the filament voltage at the rated value.

Caution should be observed when measuring rectifier filament voltage. The filament circuit may be at high potential.

The thoriated-tungsten filament of the 8020 reaches operating temperature in a fraction of a second after application of voltage. Plate voltage may be applied simultaneously with filament voltage.

Plate Operation—With low room illumination, the plate of the 8020 begins to show color as the maximum plate dissipation rating of 60 watts is approached. The maximum peak inverse voltage rating of 40,000 volts should not be exceeded at any time.

Performance—The accompanying table shows some maximum performance capabilities of the 8020 when used as a power-supply rectifier.

8020 MAXIMUM-PERFORMANCE CAPABILITIES

Circuit Type	A-C Input Voltage (volts rms)	Capacitor-Input Filter D-C Output Voltage (volts)	Capacitor-Input Filter D-C Output Current (ma)	Choke-Input Filter D-C Output Voltage (volts)	Choke-Input Filter D-C Output Current (ma)
Single-Phase, Half-Wave	14,000	17,000	80	——	——
Single-Phase, Full-Wave	14,000[1]	17,000	160	12,500	200
Single-Phase, Bridge	28,000	34,000	160	25,000	200

[1] One-half the transformer secondary voltage.

Maximum D-C Current Ratings—Plate dissipation rather than peak current usually limits the d-c current which the 8020 is capable of delivering to the load. Because the plate dissipation associated with a given d-c current depends upon the amount of ripple and its wave-shape, circuit conditions will determine the maximum d-c current rating of the tube.

Choke-Input Filter—The maximum d-c current rating of the 8020 is 100 milliamperes when the load incorporates a choke-input filter with the "critical" value (or larger) of input inductance (L_1 in Fig. 1):

$$L_o = \frac{R_{eff}}{18.8f} \quad \text{for full-wave single-phase rectifiers,}$$

$$L_o = \frac{R_{eff}}{75f} \quad \text{for half-wave three-phase rectifiers,}$$

$$L_o = \frac{R_{eff}}{660f} \quad \text{for full-wave three-phase rectifiers,}$$

where: L_o = "critical" value of input inductance (henries),

f = supply-line frequency (cycles per second),

$$R_{eff} = \frac{\text{Load voltage (volts)}}{\text{Load current (amps)}}.$$

Choke-input filters are not normally used with single-phase half-wave rectifiers.

Capacitor-Input Filter—The 8020 is particularly suitable for power-supply applications demanding high voltage at low current. Under these conditions capacitor-input filter circuits become desirable. The maximum d-c current rating of the 8020 when no input choke is incorporated in the filter depends upon the total series resistance of the capacitor-charging circuit relative to the effective load resistance seen by each tube. The circuit diagrams and tabulation in Fig. 2 are so arranged and labeled that this required series resistance may be found for a wide range of load conditions. This may be done by determining the value of the following quantities:

E_c is the filter-input d-c voltage. While this is usually the entire load voltage, in the case of voltage multipliers it is the load voltage divided by the multiplication factor.

I_p is the d-c current per tube. This is the entire load current only in the case of the simple half-wave rectifier or half- or full-wave multiplier. In the case of full-wave center-tapped or bridge rectifiers, I_p is half the load current.

R_c is the total charging-circuit resistance. A certain minimum value of charging-circuit resistance is necessary to limit the peak value of current to which the tubes will be subjected under given load conditions. This required minimum depends upon the d-c current per tube (I_p), and has been tabulated in Fig. 2 as a percentage of the effective load resistance per tube $\left(\frac{E_c}{I_p}\right)$. The total charging circuit resistance involves the internal resistance of the rectifier tube, R_p, the added series resistor, R_s, and the equivalent internal resistance of the a-c voltage supply, R_i.

R_p is the plate resistance of the 8020, which may be taken as 1000 ohms.

R_i is the equivalent internal resistance of the supply. This may be taken as the regulation of the high-voltage supply expressed as a decimal multiplied by the load resistance used in measuring this regulation.

R_s is the series resistor which must be inserted in the charging circuit to bring the total charging-circuit resistance up to the required minimum. Its value may be found from the formula associated with each of the circuits of Fig. 2. This resistor must be inserted in such a position in the circuit that it protects all tubes.

Tubes may be operated in parallel to increase the output capability in a given circuit. When two tubes are placed in parallel at each place where one is shown in the circuits of Fig. 2, the plate resistance (R_p) will be half as great and the maximum allowable load current twice as great as indicated.

Peak Inverse Voltage—The peak inverse voltage rating of the 8020 is 40,000 volts. In single-phase power-supply rectifier circuits the peak inverse voltage to be used in design is the peak a-c supply voltage (1.41 times E_{rms} in Fig. 2) in the case of bridge circuits, and twice this value in the case of half- or full-wave rectifiers and voltage multipliers. Peak inverse voltage in three-phase operation depends upon the circuit employed, and will be found listed in the handbooks.

Special Applications—The ratings given for capacitor-input filter circuits assume values of input capacitance large enough to hold the ripple to a low value. In special applications where a larger percent ripple is tolerable and filter capacitance is low, the 8020 is capable of larger d-c output currents.

As a unidirectional conductor in d-c circuits where the current is continuous and the percent ripple is moderate, the maximum current rating of the 8020 is 200 milliamperes.

The plate characteristic curve for the 8020 serves as a guide to special applications. The maximum plate dissipation rating of 60 watts, the maximum peak inverse voltage rating of 40,000 volts, and the maximum peak plate current of 1.5 ampere must not be exceeded.

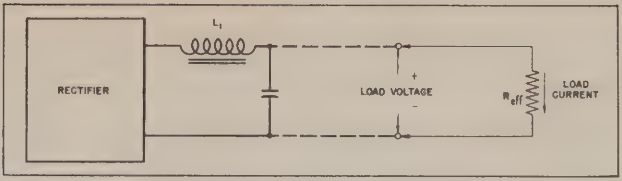
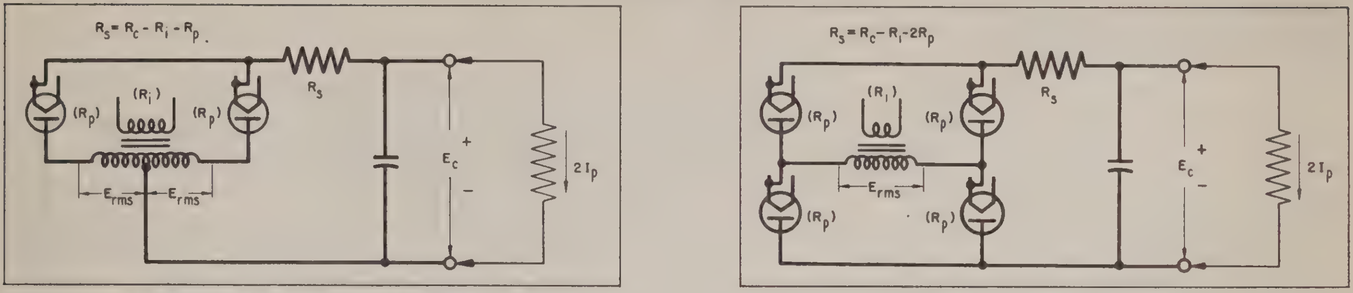
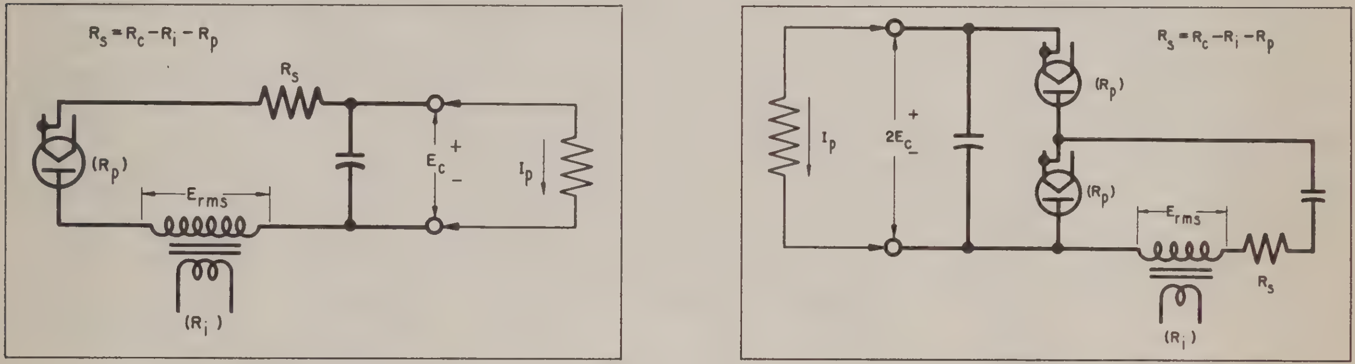


Fig. 1. Rectifier with Choke-Input Filter



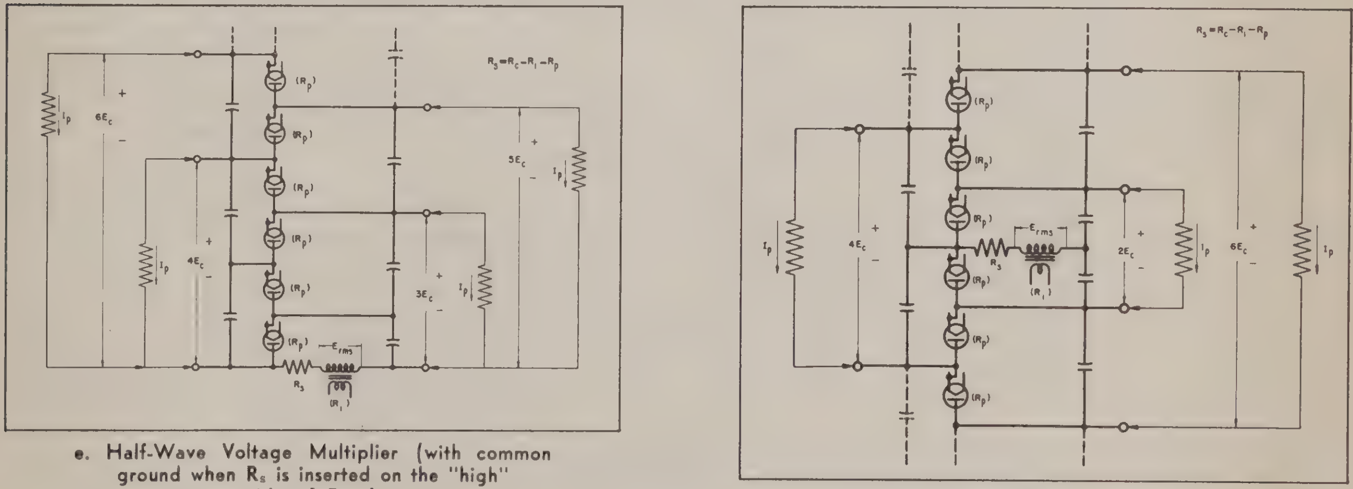
a. Full-Wave Center-Tapped Rectifier

b. Full-Wave Bridge Rectifier



c. Half-Wave Rectifier

d. Half-Wave Voltage Doubler



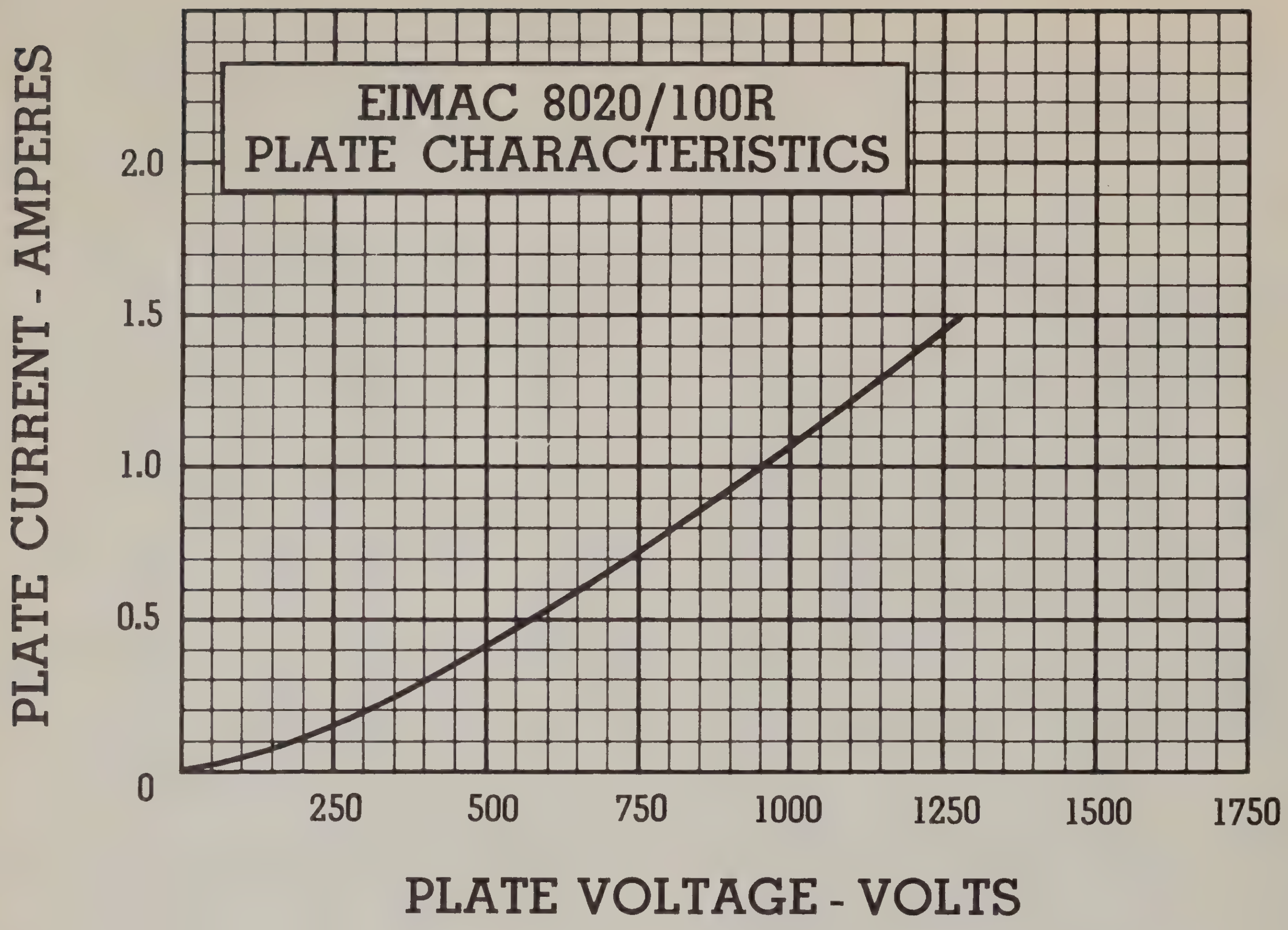
e. Half-Wave Voltage Multiplier (with common ground when R_s is inserted on the "high" side of E_{rms})

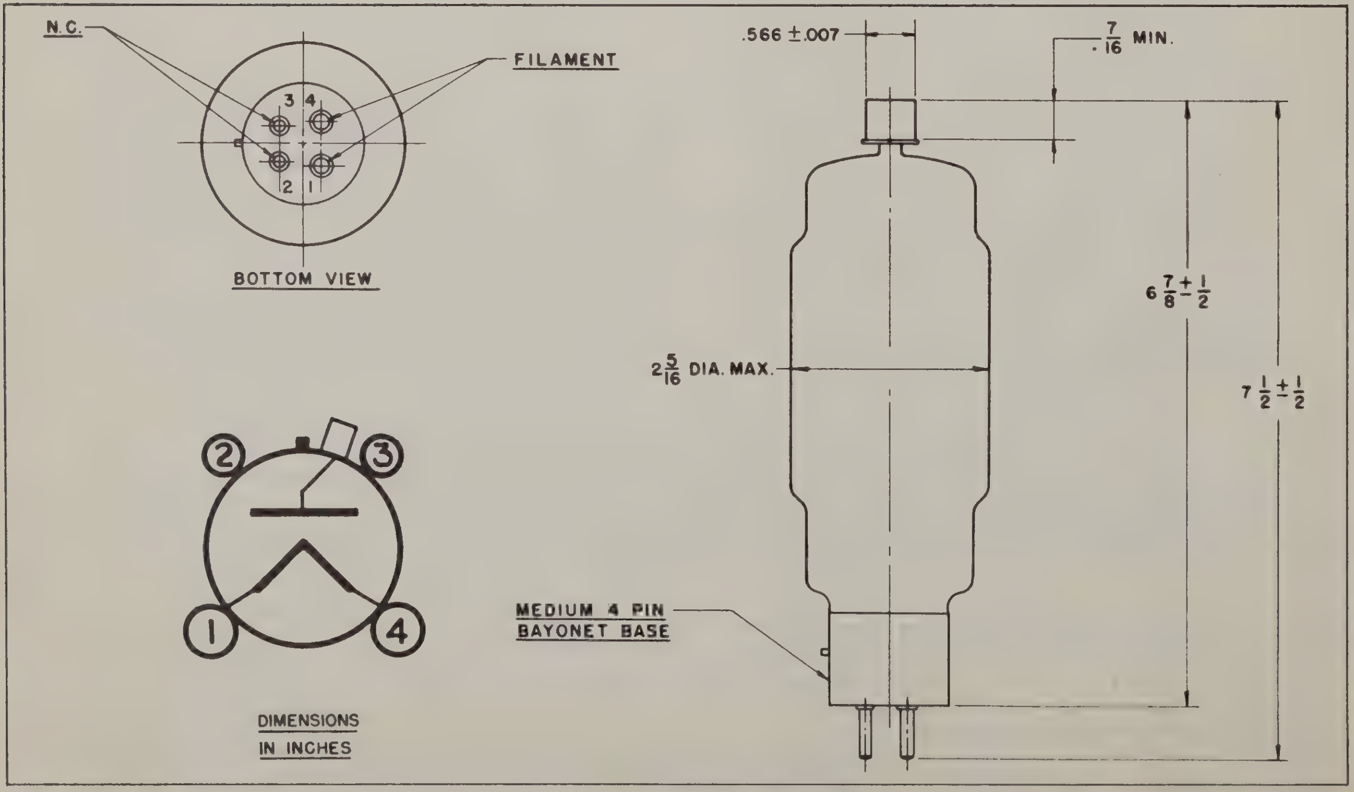
f. Full-Wave Voltage Multiplier

Eimac 8020 Maximum D-C Current Ratings for R-C Filter Applications

D-C Plate Current (I_p)	70	75	80	85	90	95	100	milliamperes per tube
Total Charging-Circuit Resistance (R_c)	0.8	1.2	1.8	3.0	4.7	7.6	12	percent of Effective Load Resistance per Tube $\left(\frac{E_c}{I_p}\right)$
A-C Supply Voltage (E_{rms})	0.78	0.80	0.83	0.87	0.92	1.01	1.14	times Filter-Input D-C Voltage (E_c)
Peak Inverse Voltage (½ these values in circuit "b".)	2.2	2.3	2.4	2.5	2.6	2.9	3.2	times Filter-Input D-C Voltage (E_c)

Fig. 2. Eimac 8020 Basic R-C Circuits (for any one of the indicated loads)
R_i = Equivalent resistance of voltage source
R_p = 1000 ohms (500 ohms for two tubes in parallel)





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EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

KY21A

GRID-CONTROLLED MERCURY VAPOR RECTIFIER

The Eimac KY21A is a grid-controlled mercury vapor rectifier. A pair of KY21A's in a conventional single phase full wave circuit will supply a d-c power output of 5 kilowatts (3500 volts at 1.5 amperes) with a choke input filter.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Coated	
Voltage	2.5 volts
Current	10 amperes
Filament Heating Time (minimum)	30 seconds
Tube Voltage Drop (average)	15 volts
Ionization Time (approximately)	10 μseconds
Deionization Time (approximately)	1000 μseconds

MECHANICAL

Base*	Medium, 5 Pin
Basing	See Outline Drawing
Maximum Overall Dimensions	
Length	8.0 inches
Diameter	2.25 inches
Net Weight	5 ounces
Shipping Weight	1 pound

MAXIMUM RATINGS (single tube)

Peak Inverse Anode Voltage	11,000 max. volts
Peak Forward Anode Voltage	5,500 max. volts
Peak Anode Current	3 max. amperes
Average Anode Current	.75 max. amperes
Supply Frequency	150 max. C.P.S.
Temperature Limits, Condensed Mercury	20° to 60° Centigrade 65° to 140° Fahrenheit

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*In order to carry the ten amperes of filament current the adjacent pins have been connected in parallel within the base. Similar connections should be made on the socket.

APPLICATION

MECHANICAL

Mounting—The KY21A must be mounted vertically, base down.

Cooling—Since the cooling of the KY21A is accomplished by radiation and convection, provision should be made for adequate air circulation around the tube. The temperature of the condensed mercury within the KY21A should be maintained at 40 degrees plus or minus 5 degrees Centigrade for best performance. To measure the condensed mercury temperature a thermocouple or small thermometer may be attached to the envelope in the area designated on the outline drawing, using a very small amount of putty.

ELECTRICAL

CAUTION SHOULD BE OBSERVED IN MEASURING THE FILAMENT VOLTAGE, AS THE FILAMENT CIRCUIT MAY BE AT A HIGH D-C POTENTIAL.

Filament Voltage—For maximum tube life the filament voltage, as measured directly at the filament pins, should be held at the rated value of 2.5 volts. Variations in filament voltage must be kept within the range of 2.4 to 2.6 volts. The filament of the KY21A should be allowed to reach operating temperature before the plate voltage is applied. Under normal conditions, a delay of approximately 30 seconds will be required. Under conditions where the tube is to be operated in extremely cold or extremely warm temperatures some external method of maintaining proper ambient temperature must be provided.

When a KY21A is first installed, the filament should be operated at rated voltage for approximately ten minutes with no plate voltage applied, in order that the mercury may be properly distributed. It will not be necessary to repeat this procedure unless the mercury is spattered on the filament and plate during subsequent handling.

Shielding—Extreme care must be exercised in preventing r-f electromagnetic and electrostatic fields from entering the circuits incorporating the KY21A. Tube "hold-off" characteristics will be materially affected in the presence of r-f fields.

Grid Circuit—The KY21A is prevented from conducting by placing a negative potential on the grid. The relationship between negative grid control voltage and anode voltage is shown in the characteristic curve. The ratio of d-c plate voltage to control voltage varies from about 87:1 at 1000 volts to 130:1 at 3500 volts. The use of slightly higher than the minimum voltage for hold-off is recommended. It may be convenient to supply 100 to 150 volts of bias from a small pack. This grid voltage is satisfactory for all normal plate voltages. It will usually be advisable to protect the grid of the KY21A by means of a current limiting resistor of approximately 10,000 ohms.

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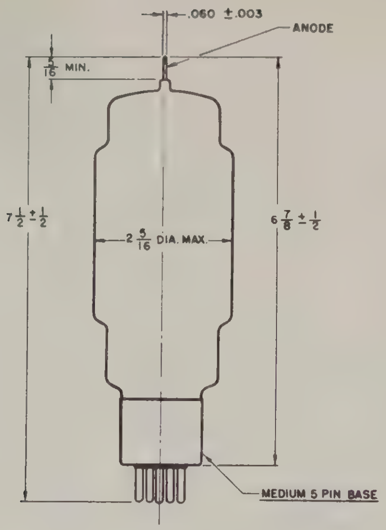

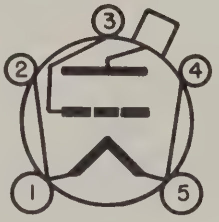

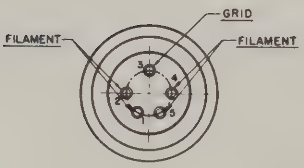

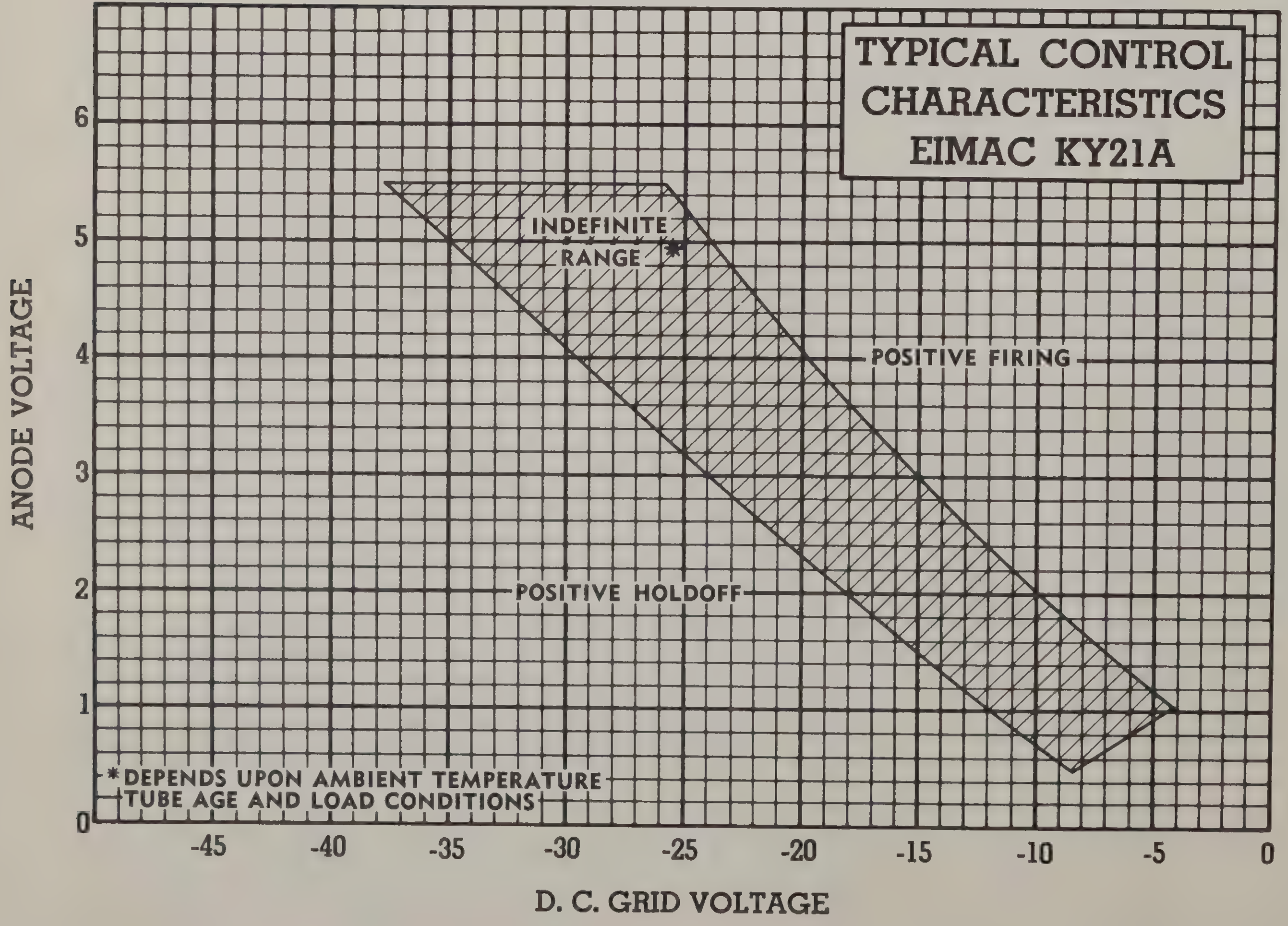
TYPICAL CONTROL CHARACTERISTICS EIMAC KY21A

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

RX21A
MERCURY VAPOR RECTIFIER

The Eimac RX21A is a half-wave mercury vapor rectifier incorporating features which enable it to withstand high peak inverse voltages and to conduct at relatively low applied voltages. The shielded ribbon filament, edgewise-wound, provides a large emmision reserve and long life.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Coated	
Voltage	2.5 volts
Current	10 amperes
Tube Voltage Drop (approx.)	15 volts

MECHANICAL

Base[1]	Medium, 5-pin
Basing	See base connection diagram
Maximum Overall Dimensions:	
Length	8.0 inches
Diameter	2.25 inches
Net Weight	5 ounces
Shipping Weight	1 pound

MAXIMUM RATINGS (single tube)

PEAK INVERSE ANODE VOLTAGE[2]	11,000 MAX. VOLTS
PEAK ANODE CURRENT	3 MAX. AMPERES
AVERAGE ANODE CURRENT	.75 MAX. AMPERES
SUPPLY FREQUENCY	150 MAX. C. P. S.
CONDENSED-MERCURY TEMPERATURE RANGE[3]	20-60 °C

APPLICATION

MECHANICAL

MOUNTING—The RX21A must be mounted vertically, base down.

COOLING—Provisions should be made for adequate air circulation around the tube, because cooling is accomplished by convection. The temperature of the condensed-mercury in the RX21A should be kept within the ranges given under "MAXIMUM RATINGS". This temperature should be maintained at 40 degrees plus or minus 5 degrees C for most satisfactory operation of the tube. To measure the condensed-mercury temperature a thermocouple or small thermometer may be attached to the bulb in the area designated on the outline drawing, using a very small amount of putty. A condensed-mercury temperature lower than the recommended value raises the voltage at which the tube becomes conducting and tends to reduce the life of the filament. A temperature higher than recommended lowers the voltage at which the tube becomes conducting and tends to increase the life of the filament, but reduces the peak inverse voltage rating of the tube. When it is necessary to use a shield around the RX21A care must be taken to insure adequate ventilation and maintenance of normal condensed-mercury temperature.

ELECTRICAL

CAUTION SHOULD BE OBSERVED IN MEASURING THE FILAMENT VOLTAGE, AS THE FILAMENT CIRCUIT MAY BE AT A HIGH D-C POTENTIAL.

FILAMENT VOLTAGE—For maximum tube life, the filament voltage as measured directly at the filament pins, should be held at the rated value of 2.5 volts. Unavoidable variations in filament voltage must be kept within the range of 2.4 to 2.6 volts. A filament voltage less than the minimum recommended value may cause a high tube voltage drop, with consequent bombardment of the filament and eventual loss of emission. A filament voltage higher than the recommended maximum value will also decrease the life of the filament.

The plate-circuit return of each tube should preferably be connected to the center tap of the transformer winding supplying the filament voltage. This precaution is recommended to insure uniform starting voltage for each tube when several are used in a given circuit.

The filament of the RX21A should be allowed to reach operating temperature before the plate voltage is applied. Under normal conditions, a delay of approximately 30 seconds will be required. The delay time should be increased if there is any evidence of arc-back within the tube. In radio transmitter applications the filament should be kept at its rated voltage during "standby" periods to avoid delay due to warm-up. It is desirable to use a protective relay in the plate circuit to prevent the application of plate voltage before the filament has reached operating temperature. This relay should have a time delay adjustable up to a maximum of one minute.

When an RX21A is first installed, the filament should be operated at normal voltage for approximately ten minutes with no plate voltage applied, in order that the mercury may be properly distributed. It will not be necessary to repeat this procedure unless the mercury is spattered on the filament and plate during subsequent handling.

SHIELDING—Electromagnetic and electrostatic fields tend to cause the mercury vapor to break down, are detrimental to tube life and make proper operation difficult. Consequently, the RX21A should be isolated from such fields as exist around a transmitter or other similar equipment. When the tubes are located in the region of such fields, shielding with adequate ventilation should be used around the tubes. R-f filtering should also be employed when the tubes are affected by r-f voltages.

FILTERING—A "choke input" filter will allow the greatest usable d-c output current to the load. When using a section of filter between rectifier and load, to prevent exceeding the maximum peak current of 3 amperes, a suitable maximum value for the first capacitor should be determined. Determination of this capacitance should be made under conditions simulating those to be used in service.

The relationship of voltage input, inductance, and capacitance is one in which a higher operating voltage requires greater input inductance, and less following capacitance to keep the peak STARTING current from exceeding 3 amperes. This is for the usual case where the supply is controlled by an on-off switch.

Where the rectifier plate voltage is started by a control which gradually raises the voltage from zero or a small amount to the desired operating value, starting current need not ordinarily be considered, and the chaarcteristics of the filter may be based on preventing excessive peak current under normal operating conditions.

In the single phase cricuits (1 and 3), if the current drawn by the load is reduced or varies under operating conditions to values less than approximately 70% of the indicated maximum d-c load current, a swinging (input) choke will supply the necessary additional inductance to prevent the voltage from rising, and will afford proper filtering over a much greater current range.

Where a larger value of inductance is desirable to obtain additional filtering, the subsequent capacitance may be proportionately increased to aid in still further filtering without excessive peak starting and operating current. Still lower ripple may of course be obtained by added sections of filter.

When "condenser input" filter is used, the peak current will be relatively high in respect to the usable load current, and the voltage across the capacitor may be as high as 1.4 times the nominal RMS voltage of the transformer.

For parallel operation of RX21A rectifiers, suitable resistors or small inductors may be used in series with each plate lead to permit equal loading and starting characteristics. The inductors aid in reducing the peak current, and are more desirable due to their low d-c resistance. An approximate value for suitable resistors is 50 ohms, and for inductors, apprroximately one-third henry each.

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[1] In order to carry the ten amperes of filament current the adjacent pins have been connected in parallel within the base. Similar connections should be made in the socket.

[2] Temperatures in excess of 60° C limit the peak-inverse rating to 5,000 volts with a corresponding reduction in permissible RMS supply voltages to one-half those listed in the table.

[3] Operation at 40° plus or minus 5° C is recommended.

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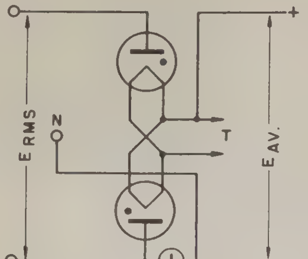

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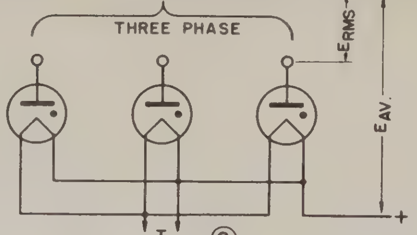

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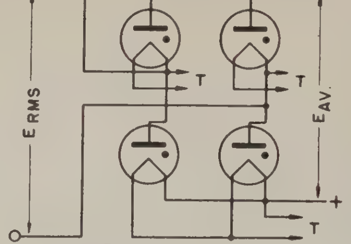

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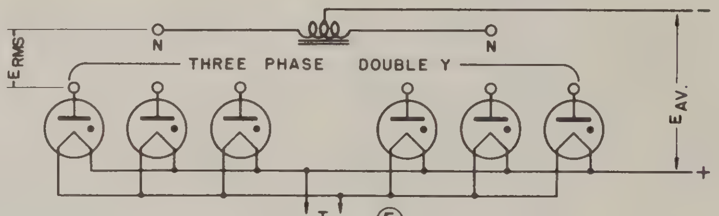

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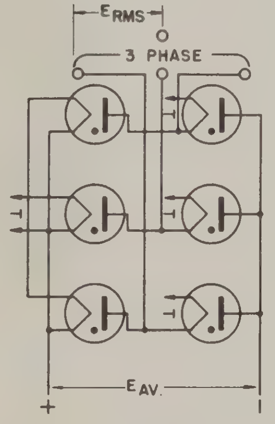
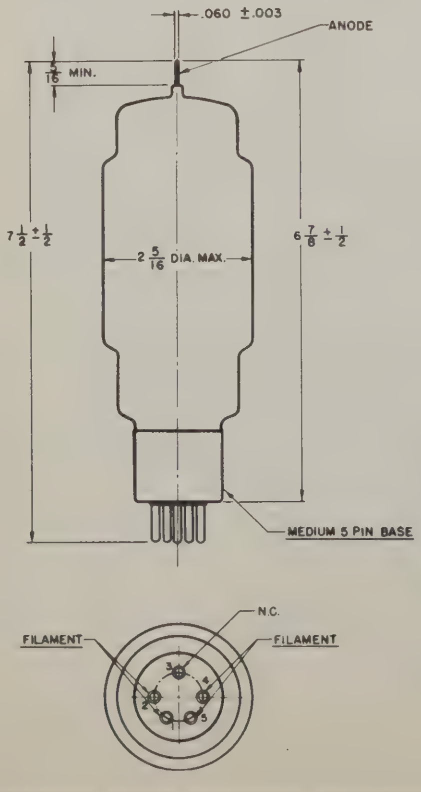


④

NUMBER	CIRCUIT	$E_{AVERAGE}$	$E_{INVERSE}$
①	SINGLE - PHASE FULL - WAVE 2 TUBES	$0.318\ E_{PEAK}$ $0.450\ E_{RMS}$	$3.14\ E_{AVERAGE}$
②	THREE - PHASE HALF - WAVE	$0.827\ E_{PEAK}$ $1.170\ E_{RMS}$	$2.09\ E_{AVERAGE}$
③	SINGLE - PHASE FULL - WAVE 4 TUBES	$0.636\ E_{PEAK}$ $0.900\ E_{RMS}$	$1.57\ E_{AVERAGE}$
④	THREE - PHASE FULL - WAVE	$1.65\ E_{PEAK}$ $2.34\ E_{RMS}$	$1.045\ E_{AVERAGE}$
⑤	THREE - PHASE DOUBLE - Y PARALLEL	$0.827\ E_{PEAK}$ $1.170\ E_{RMS}$	$2.09\ E_{AVERAGE}$

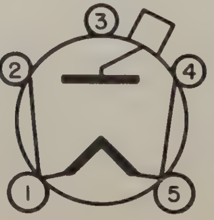
CONDITIONS ASSUMED

SINE WAVE SUPPLY, BALANCED PHASE VOLTAGES, ZERO TUBE DROP, PURE RESISTANCE LOAD, OR CHOKE INPUT FILTER.



CIRCUIT	INPUT VOLTS* MAX. A-C (RMS)	APPROX. D-C OUTPUT VOLTS TO FILTER	MAX. D-C CURRENT OUTPUT (Amperes)
①	3890 per tube	3510	1.5
②	4490 per leg	5270	2.25
③	7780 total	7020	1.5
④	4490 per leg	10,520	2.25
⑤	4490 per leg	5270	4.5

*For use under the conditions of the 11,000 volt peak inverse rating. If the RX21A is to be used under frequency and/or temperature condition such that the peak inverse voltage is limited to 5500 volts, the a-c input voltage and d-c output voltage values in the table should be multiplied by a factor of 0.5 to give new values for the 5500 volt condition.



EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

866A
866
MERCURY VAPOR RECTIFIER

The Eimac 866-A/866 is a half-wave mercury-vapor rectifier incorporating features which enable it to withstand high peak-inverse voltages and to conduct at relatively low applied-voltages. The shielded ribbon filament, edgewise-wound, provides a large emission reserve and long life.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Coated		
Voltage	2.5	volts
Current	5.0	amperes
Tube Voltage Drop (approx.)	15	volts

MECHANICAL

Base	Medium 4-pin bayonet, RMA A4-10	
Basing	See base connection diagram	
Maximum Overall Dimensions:		
Length	6.5	inches
Diameter	2.5	inches
Net Weight (Approx.)	2	ounces
Shipping Weight (Average)	0.5	pounds

MAXIMUM RATINGS (single tube)

PEAK INVERSE ANODE VOLTAGE	2,000	5,000	10,000	MAX. VOLTS
PEAK ANODE CURRENT	2.0	1.0	1.0	MAX. AMPERES
AVERAGE ANODE CURRENT	0.5	0.25	0.25	MAX. AMPERES
SUPPLY FREQUENCY	150	1,000	150	MAX. C. P. S.
CONDENSED-MERCURY TEMPERATURE RANGE[1]	25-70	25-70	25-60	°C

[1] Operation at 40 degrees plus or minus 5 degrees C is recommended.

APPLICATION

MECHANICAL

MOUNTING—The 866-A/866 must be mounted vertically, base down.

COOLING—Provision should be made for adequate air circulation around the tube, because cooling is accomplished by convection. The temperature of the condensed-mercury in the 866-A/866 should be kept within the ranges given under "MAXIMUM RATINGS". This temperature should be maintained at 40 degrees plus or minus 5 degrees C for most satisfactory operation of the tube. To measure the condensed-mercury temperature a thermocouple or small thermometer may be attached to the bulb in the area designated on the outline drawing, using a very small amount of putty. A condensed-mercury temperature lower than the recommended value raises the voltage at which the tube becomes conducting and tends to reduce the life of the filament. A temperature higher than recommended lowers the voltage at which the tube becomes conducting and tends to increase the life of the filament, but reduces the peak inverse voltage rating of the tube. When it is necessary to use a shield around the 866-A/866 care must be taken to insure adequate ventilation and maintenance of normal condensed-mercury temperature.

ELECTRICAL

FILAMENT VOLTAGE—For maximum tube life, the filament voltage as measured directly at the filament pins, should be held at the rated value of 2.5 volts. Unavoidable variations in filament voltage must be kept within the range of 2.38 to 2.63 volts. A filament voltage less than the minimum recommended value may cause a high tube voltage drop, with consequent bombardment of the filament and eventual loss of emission. A filament voltage higher than the recommended maximum value will also decrease the life of the filament.

CAUTION SHOULD BE OBSERVED IN MEASURING THE FILAMENT VOLTAGE, AS THE FILAMENT CIRCUIT MAY BE AT A HIGH D-C POTENTIAL.

The plate-circuit return of each tube should preferably be connected to the center tap of the transformer winding supplying the filament voltage; if this cannot be done, the return should be connected to that side of the filament to which the cathode shields are connected (pin No. 4). When the filaments of two or more tubes are connected in parallel, the filament terminals to which the cathode shields are connected should be joined. These precautions are recommended to insure uniform starting voltage for each tube when several are used in a given circuit.

The filament of the 866-A/866 should be allowed to reach operating temperature before the plate voltage is applied. Under normal conditions, a delay of approximately 15 seconds will be required. The delay time should be increased if there is any evidence of arc-back within the tube. In radio transmitter applications the filament should be kept at its rated voltage during "standby" periods to avoid delay due to warm-up. It is desirable to use a protective relay in the plate circuit to prevent the application of plate voltage before the filament has reached operating temperature. This relay should have a time delay adjustable up to a maximum of one minute.

When an 866-A/866 is first installed, the filament should be operated at normal voltage for approximately ten minutes with no plate voltage applied, in order that the mercury may be properly distributed. It will not be necessary to repeat this procedure unless the mercury is spattered on the filament and plate during subsequent handling.

SHIELDING—Electromagnetic and electrostatic fields tend to cause the mercury vapor to break down, are detrimental to tube life and make proper filtering difficult. Consequently, the 866-A/866 should be isolated from such fields as exist around a transmitter or other similar equipment. When the tubes are located in the region of such fields, shielding with adequate ventilation should be used around the tubes. R-f filtering should also be employed when the tubes are affected by r-f voltages.

FILTERING—The nomograph for circuits 1 and 3, and tables for circuits 2, 4 and 5 give empirical values of inductance and capacitance for a single-section choke-input filter which will keep the peak plate current below the maximum rated value, provided the average d-c load current does not exceed the maximum load current indicated. The values of L and C are based on a power-supply frequency of 60 cycles.

The value of the capacitor is made small enough to prevent excessive surges when power is first applied to the circuit. If the available inductance is larger than the minimum allowable value, the capacitance may be increased proportionately over its nomograph or table maximum. In a two-section filter with two unequal inductances, the input inductances should be the larger. The maximum value of each capacitor in such a filter is based upon the value of the preceding inductance.

In the single phase circuits (1 and 3), if the current drawn by the load is reduced or varies under operating conditions to values less than approximately 70% of the indicated maximum d-c load current, a swinging (input) choke will supply the necessary additional inductance to prevent the voltage from rising, and will afford proper filtering over a much greater current range.

Arrangements such as those shown in Circuits 1, 2 and 3 produce less than 5% ripple voltage when a two-section filter with minimum inductance and corresponding maximum capacitance is employed. Circuits such as those shown in circuits 4 and 5 will produce less than 1% ripple voltage. Better filtering may be obtained with any of these circuits by using larger values of inductance than the minimum indicated. Still greater improvement may be had by then proportionately increasing the corresponding capacitor values.

When "condenser input" filter is used, the peak current will be relatively high in respect to the usable load current, and the voltage across the capacitor may be as high as 1.4 times the nominal RMS voltage of the transformer.

For parallel operation of 866-A/866 rectifiers, suitable resistors or small inductors may be used in series with each plate lead to permit equal loading and starting characteristics. The inductors aid in reducing the peak current, and are more desirable due to their low d-c resistance. An approximate value for suitable resistors is 50 ohms, and for inductors, approximately one-third henry each.

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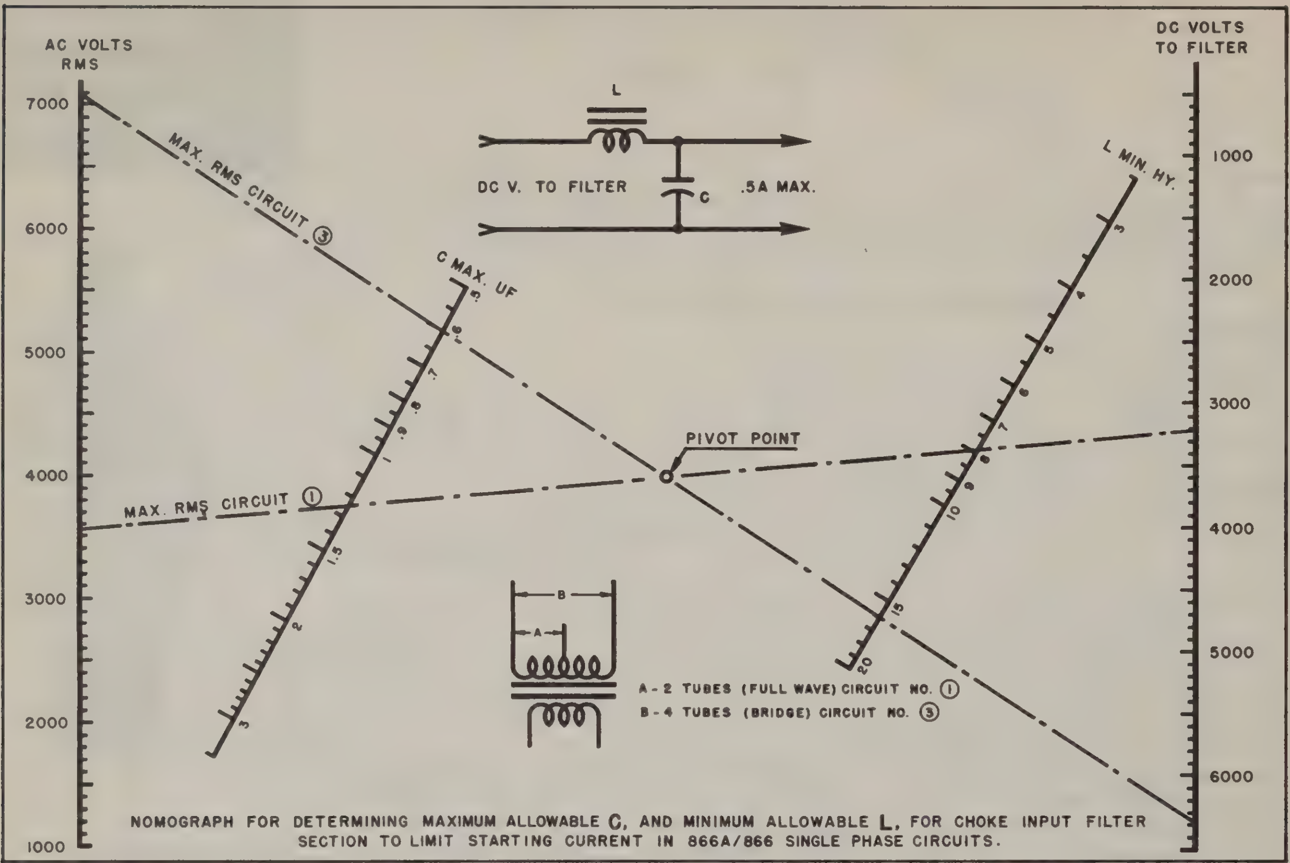
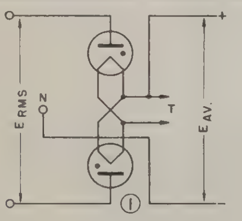
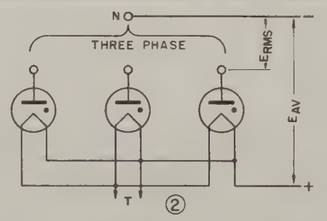
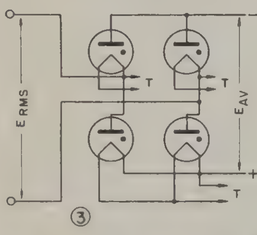
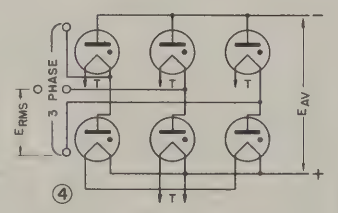


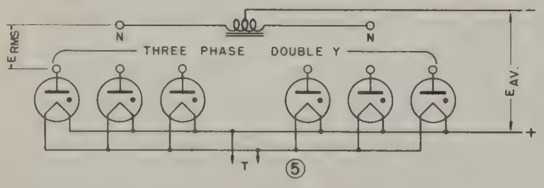
NOMOGRAPH FOR DETERMINING MAXIMUM ALLOWABLE C, AND MINIMUM ALLOWABLE L, FOR CHOKE INPUT FILTER SECTION TO LIMIT STARTING CURRENT IN 866A/866 SINGLE PHASE CIRCUITS.









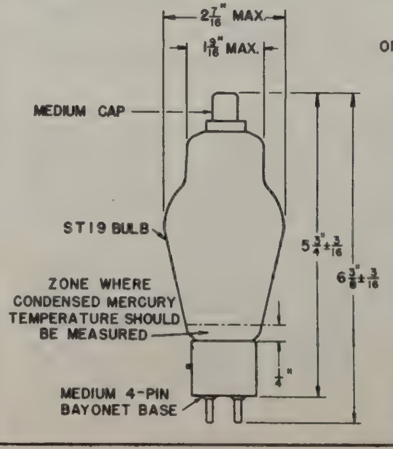


NUMBER	CIRCUIT	$E_{AVERAGE}$	$E_{INVERSE}$
①	Single-Phase Full-Wave 2 Tubes	$0.318\ E_{PEAK}$ $0.450\ E_{RMS}$	$3.14\ E_{AVERAGE}$
②	Three-Phase Half-Wave	$0.827\ E_{PEAK}$ $1.170\ E_{RMS}$	$2.09\ E_{AVERAGE}$
③	Single-Phase Full-Wave 4 Tubes	$0.636\ E_{PEAK}$ $0.900\ E_{RMS}$	$1.57\ E_{AVERAGE}$
④	Three-Phase Full-Wave	$1.65\ E_{PEAK}$ $2.34\ E_{RMS}$	$1.045\ E_{AVERAGE}$
⑤	Three-Phase Double-Y Parallel	$0.827\ E_{PEAK}$ $1.170\ E_{RMS}$	$2.09\ E_{AVERAGE}$

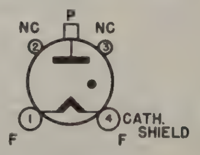
CONDITIONS ASSUMED
(A) Sine Wave Supply (B) Balanced Phase Voltages
(C) Zero Tube Drop (D) Pure Resistance Load,
or Choke Input Filter

CIRCUIT	A-C INPUT VOLTS* (RMS)	MAX. D-C OUTPUT VOLTS TO FILTER	CHOKE INPUT ONE-SECTION FILTER MIN. CHOKE (L) henrys	CHOKE INPUT ONE-SECTION FILTER MAX. CONDENSER (C) µf	MAX. D-C LOAD CURRENT amperes
	per tube				
SINGLE-PHASE FULL-WAVE (2 Tubes) CIRCUIT ①	3535	3180	8.0	1.25	0.5
	3000	2700	6.8	1.5	0.5
	2000	1800	4.5	2.1	0.5
	1500	1350	3.4	2.8	0.5
	per leg				
THREE-PHASE HALF-WAVE CIRCUIT ②	4080	4780	3.2	1.4	0.75
	3000	3510	2.2	2.0	0.75
	2000	2340	1.4	3.0	0.75
	1500	1750	1.1	4.0	0.75
	total				
SINGLE-PHASE FULL-WAVE (4 Tubes) CIRCUIT ③	7070	6360	16.0	0.6	0.5
	6000	5400	13.5	0.7	0.5
	5000	4500	11.0	0.9	0.5
	4000	3600	8.9	1.1	0.5
	per leg				
THREE-PHASE FULL-WAVE CIRCUIT ④	4080	9570	1.8	0.5	0.75
	3000	7020	1.4	0.7	0.75
	2000	4680	0.9	1.2	0.75
	1500	3510	0.7	1.5	0.75
	per leg				
THREE-PHASE DOUBLE-Y PARALLEL CIRCUIT ⑤	4080	4780	2.0	0.5	1.5
	3000	3510	1.5	0.7	1.5
	2000	2340	1.0	1.1	1.5
	1500	1750	0.7	1.5	1.5

*For use under the conditions of the 10000-volt peak inverse rating. If the 866-A/866 is to be used under frequency and/or temperature conditions such that the peak inverse voltage is limited to 5000 volts, the a-c input voltage and d-c output voltage values in the table should be multiplied by a factor of 0.5 to give new values for the 5000-volt conditions.


2 7/16" MAX.
1 9/16" MAX.
MEDIUM CAP
ST19 BULB
5 3/4" ± 3/16
6 3/8" ± 3/16
ZONE WHERE CONDENSED MERCURY TEMPERATURE SHOULD BE MEASURED
1/4"
MEDIUM 4-PIN BAYONET BASE

BOTTOM VIEW
OF SOCKET CONNECTIONS



PIN 1 - FILAMENT
PIN 2 - NO CONNECTION
PIN 3 - NO CONNECTION
PIN 4 - FILAMENT
CAP - PLATE

● = GAS-TYPE TUBE

TUBE MOUNTING POSITION

VERTICAL - BASE DOWN ONLY

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

872A
872
MERCURY VAPOR RECTIFIER

The Eimac 872-A/872 is a half-wave mercury-vapor rectifier incorporating features which enable it to withstand high peak-inverse voltages and to conduct at relatively low applied-voltages. The shielded ribbon filament, edgewise-wound, provides a large emission reserve and long life.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Coated		
Voltage	5.0	volts
Current	7.5	amperes
Tube Voltage Drop (approx.)	10	volts

MECHANICAL

Base	Jumbo 4-pin, RMA type A4-29
Basing	See base connection diagram
Maximum Overall Dimensions:	
Length	8.5 inches
Diameter	2.31 inches
Net Weight (Approx.)	8 ounces
Shipping Weight (Average)	1.5 pounds

MAXIMUM RATINGS (single tube)

PEAK INVERSE ANODE VOLTAGE[1]	10,000	MAX. VOLTS
PEAK ANODE CURRENT	5	MAX. AMPERES
AVERAGE ANODE CURRENT	1.25	MAX. AMPERES
SUPPLY FREQUENCY	150	MAX. C. P. S.
CONDENSED-MERCURY TEMPERATURE RANGE[2]	20-60	°C

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[1] Temperatures in excess of 60° C limit the peak-inverse rating to 5,000 volts with a corresponding reduction in permissible RMS supply voltages to one-half those listed in the table.

[2] Operation at 40° plus or minus 5° C is recommended.

APPLICATION

MECHANICAL

MOUNTING—The 872-A/872 must be mounted vertically, base down.

COOLING—Provision should be made for adequate air circulation around the tube, because cooling is accomplished by convection. The temperature of the condensed-mercury in the 872-A/872 should be kept within the ranges given under "MAXIMUM RATINGS". This temperature should be maintained at 40 degrees plus or minus 5 degrees C for most satisfactory operation of the tube. To measure the condensed-mercury temperature a thermocouple or small thermometer may be attached to the bulb in the area designated on the outline drawing, using a very small amount of putty. A condensed-mercury temperature lower than the recommended value raises the voltage at which the tube becomes conducting and tends to reduce the life of the filament. A temperature higher than recommended lowers the voltage at which the tube becomes conducting and tends to increase the life of the filament, but reduces the peak inverse voltage rating of the tube. When it is necessary to use a shield around the 872-A/872, care must be taken to insure adequate ventilation and maintenance of normal condensed-mercury temperature.

ELECTRICAL

FILAMENT VOLTAGE—For maximum tube life, the filament voltage as measured directly at the filament pins, should be held at the rated value of 5.0 volts. Unavoidable variations in filament voltage must be kept within the range of 4.75 to 5.25 volts. A filament voltage less than the minimum recommended value may cause a high tube voltage drop, with consequent bombardment of the filament and eventual loss of emission. A filament voltage higher than the recommended maximum value will also decrease the life of the filament.

CAUTION SHOULD BE OBSERVED IN MEASURING THE FILAMENT VOLTAGE, AS THE FILAMENT CIRCUIT MAY BE AT A HIGH D-C POTENTIAL.

The plate-circuit return of each tube should preferably be connected to the center tap of the transformer winding supplying the filament voltage; if this cannot be done, the return should be connected to that side of the filament to which the cathode shields are connected (pin No. 2). When the filaments of two or more tubes are connected in parallel, the filament terminals to which the cathode shields are connected should be joined. These precautions are recommended to insure uniform starting voltage for each tube when several are used in a given circuit.

The filament of the 872-A/872 should be allowed to reach operating temperature before the plate voltage is applied. Under normal conditions, a delay of approximately 30 seconds will be required. The delay time should be increased if there is any evidence of arc-back within the tube. In radio transmitter applications the filament should be kept at its rated voltage during "standby" periods to avoid delay due to warm-up. It is desirable to use a protective relay in the plate circuit to prevent the application of plate voltage before the filament has reached operating temperature. This relay should have a time delay adjustable up to a maximum of one minute.

When an 872-A/872 is first installed, the filament should be operated at normal voltage for approximately ten minutes with no plate voltage applied, in order that the mercury may be properly distributed. It will not be necessary to repeat this procedure unless the mercury is spattered on the filament and plate during subsequent handling.

SHIELDING—Electromagnetic and electrostatic fields tend to cause the mercury vapor to break down, are detrimental to tube life and make proper filtering difficult. Consequently, the 872-A/872 should be isolated from such fields as exist around a transmitter or other similar equipment. When the tubes are located in the region of such fields, shielding with adequate ventilation should be used around the tubes. R-f filtering should also be employed when the tubes are affected by r-f voltages.

FILTERING—A "choke input" filter will allow the greatest usable d-c output current to the load. When using a section of filter between rectifier and load, to prevent exceeding the maximum peak current of 5 amperes, a suitable maximum value for the first capacitor should be determined. Determination of this capacitance should be made under conditions simulating those to be used in service.

The relationship of voltage input, inductance, and capacitance is one in which a higher operating voltage requires greater input inductance, and less following capacitance to keep the peak STARTING current from exceeding 5 amperes. This is for the usual case where the supply is controlled by an on-off switch.

Where the rectifier plate voltage is started by a control which gradually raises the voltage from zero or a small amount to the desired operating value, starting current need not ordinarily be considered, and the characteristics of the filter may be based on preventing excessive peak current under normal operating conditions.

In the single phase circuits (1 and 3), if the current drawn by the load is reduced or varies under operating conditions to values less than approximately 70% of the indicated maximum d-c load current, a swinging (input) choke will supply the necessary additional inductance to prevent the voltage from rising, and will afford proper filtering over a much greater current range.

Where a larger value of inductance is desirable to obtain additional filtering, the subsequent capacitance may be proportionately increased to aid in still further filtering without excessive peak starting and operating current. Still lower ripple may of course be obtained by added sections of filter.

When "condenser input" filter is used, the peak current will be relatively high in respect to the usable load current, and the voltage across the capacitor may be as high as 1.4 times the nominal RMS voltage of the transformer.

For parallel operation of 872-A/872 rectifiers, suitable resistors or small inductors may be used in series with each plate lead to permit equal loading and starting characteristics. The inductors aid in reducing the peak current, and are more desirable due to their low d-c resistance. An approximate value for suitable resistors is 50 ohms, and for inductors, approximately one-third henry each.

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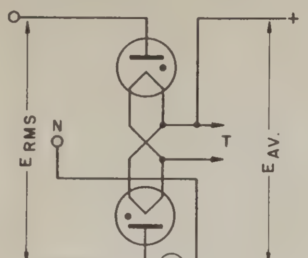

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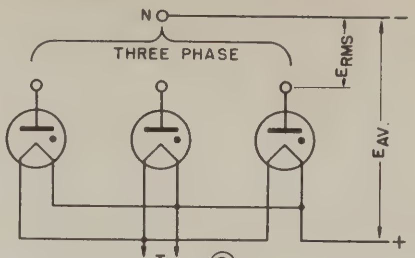

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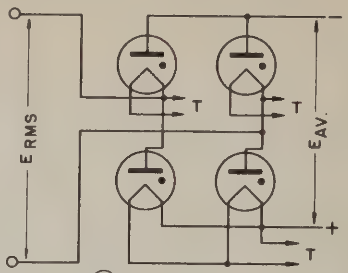

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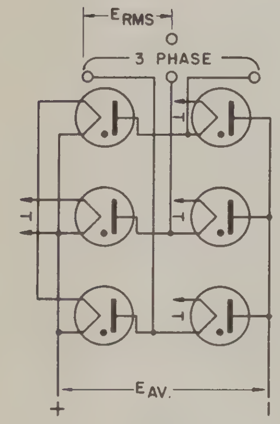

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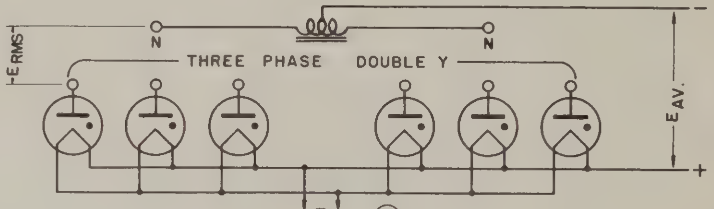
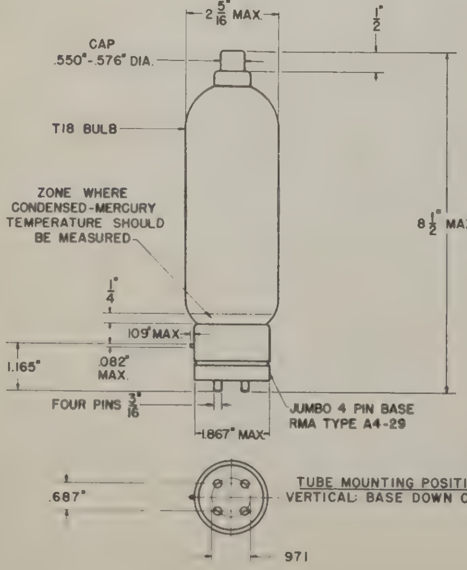


⑤

NUMBER	CIRCUIT	$E_{AVERAGE}$	$E_{INVERSE}$	$I_{AVERAGE}$
①	SINGLE - PHASE FULL - WAVE 2 TUBES	$0.318\ E_{MAXIMUM}$ $0.450\ E_{RMS}$	$3.14\ E_{AVERAGE}$	$0.636\ I_{MAXIMUM}$
②	THREE - PHASE HALF - WAVE	$0.827\ E_{MAXIMUM}$ $1.170\ E_{RMS}$	$2.09\ E_{AVERAGE}$	$0.827\ I_{MAXIMUM}$
③	SINGLE - PHASE FULL - WAVE 4 TUBES	$0.636\ E_{MAXIMUM}$ $0.900\ E_{RMS}$	$1.57\ E_{AVERAGE}$	$0.636\ I_{MAXIMUM}$
④	THREE - PHASE FULL - WAVE	$1.65\ E_{MAXIMUM}$ $2.34\ E_{RMS}$	$1.045\ E_{AVERAGE}$	$0.955\ I_{MAXIMUM}$
⑤	THREE - PHASE DOUBLE - Y PARALLEL	$0.827\ E_{MAXIMUM}$ $1.170\ E_{RMS}$	$2.09\ E_{AVERAGE}$	$1.91\ I_{MAXIMUM}$

CONDITIONS ASSUMED

SINE WAVE SUPPLY, BALANCED PHASE VOLTAGES, ZERO TUBE DROP, PURE RESISTANCE LOAD. NO FILTER USED.



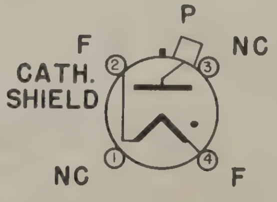
TUBE MOUNTING POSITION

VERTICAL: BASE DOWN ONLY.

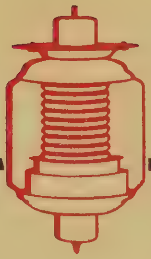
CIRCUIT	INPUT VOLTS[1] MAXIMUM A-C (RMS)	APPROX. D-C OUTPUT VOLTS TO FILTER	MAXIMUM D-C OUTPUT CURRENT AMPERES
1	3535 per tube	3180	2.5
2	4080 per leg	4780	3.75
3	7070 total	6360	2.5
4	4080 per leg	9570	3.75
5	4080 per leg	4780	7.5

[1] Max. peak inverse voltage of 10,000 volts.

BOTTOM VIEW OF SOCKET CONNECTIONS



PIN 1 - NO CONNECTION
PIN 2 - FILAMENT, CATHODE SHIELD
PIN 3 - NO CONNECTION
PIN 4 - FILAMENT
CAP - PLATE
• - GAS TYPE TUBE



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Field Engineering. Serving as an extension of the Application Engineering Department outside the Eimac plant, Eimac field engineers cover the United States, operate out of offices in major cities. They will help you personally with experimental work, problems of technique, etc. Engineers from the Eitel-McCullough plant in San Bruno are available, too, for field consultation throughout the country. As Eimac tubes are world renowned, the same services extend to various countries overseas through the Eimac export division.

other products

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

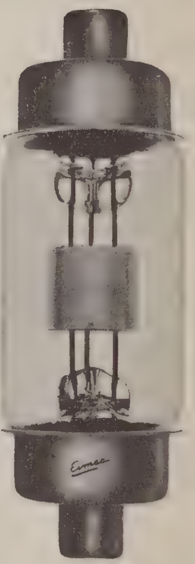
VACUUM CAPACITORS

VC50-32 VC50-20
VC25-32 VC25-20
VC12-32 VC12-20
VC6 - 32 VC6 - 20

Eimac vacuum capacitors are small, vacuum-dielectric units intended principally for use as all or part of the plate tank capacitance in radio-frequency amplifiers or oscillators. They are also frequently used as high-voltage coupling and by-pass capacitors at high frequencies and as high-voltage neutralizing capacitors, when used in conjunction with small high-voltage variable capacitors having a small capacitance range. The use of a vacuum as a dielectric permits the construction of a comparatively small, lightweight capacitor for a given voltage rating and capacitance. In addition, the effects of dust and atmospheric conditions on the capacitor are eliminated by sealing the plates within a glass envelope.

These capacitors are manufactured in two maximum peak voltage ratings, 32,000 and 20,000 volts, and in capacitances of 6, 12, 25 and 50 uufd. All types have a maximum current rating of 28 amperes. Each of the capacitors may be operated at its full maximum voltage rating at any frequency below that at which the rms current through the capacitor is 28 amperes. Above this frequency, the r-f voltage across the capacitor must be reduced as the frequency increases, to prevent the current from exceeding the maximum rating. The graphs below show the maximum peak r-f voltage which may be applied to each type of capacitor at frequencies between 100 kilocycles and 50 megacycles. Curves are also shown which indicate the rms current flowing through the capacitor under maximum r-f voltage conditions at any frequency between 100 kilocycles and 50 megacycles. Where both r-f and d-c voltages are applied to the capacitor, the sum of the peak r-f and d-c voltages must not exceed the peak voltage rating of the capacitor.

Eimac vacuum capacitors are provided with terminals which allow the use of standard 60-ampere fuse clips for mounting. These clips must be kept clean and must at all times make firm and positive contact with the capacitor terminals. Failure to maintain a low-resistance contact to the capacitor terminals may result in excessive heating and permanent damage to the capacitor seals.

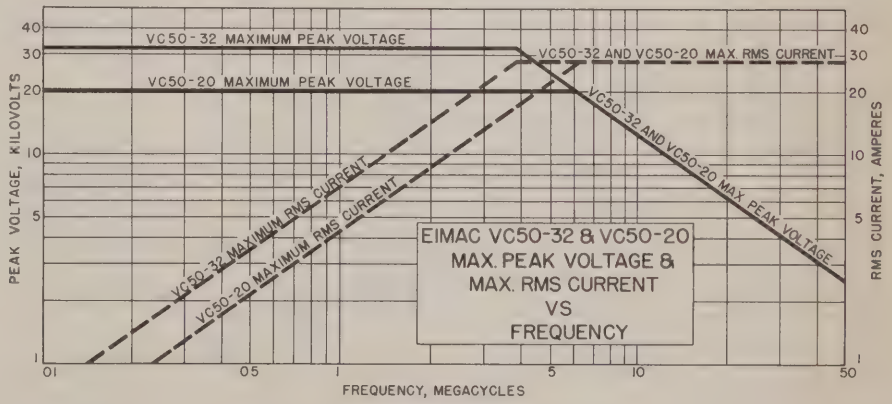


VC50-32

Capacitance*	50 μμfd.
Max. Peak Voltage	32,000 volts
Max. RMS Current	28 amps.

VC50-20

Capacitance*	50 μμfd.
Max. Peak Voltage	20,000 volts
Max. RMS Current	28 amps.

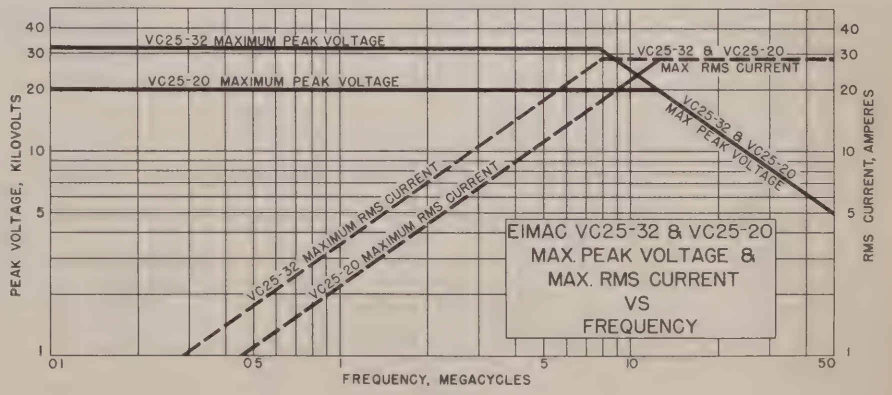


VC25-32

Capacitance*	25 μμfd.
Max. Peak Voltage	32,000 volts
Max. RMS Current	28 amps.

VC25-20

Capacitance*	25 μμfd.
Max. Peak Voltage	20,000 volts
Max. RMS Current	28 amps.



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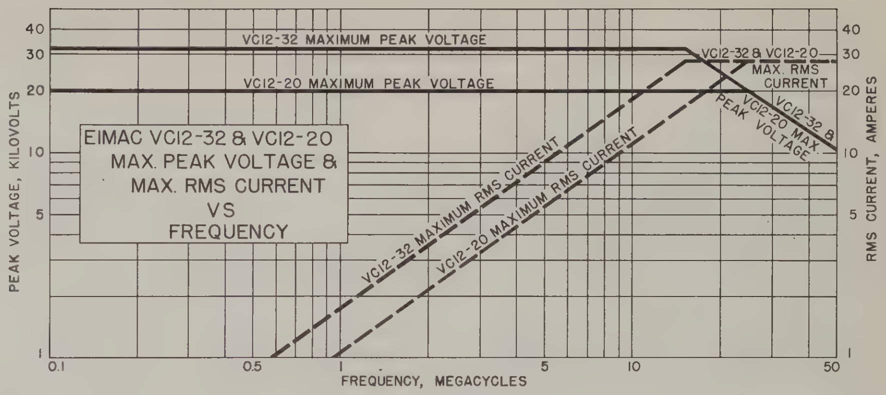
VC12-32

Capacitance*	12 μμfd.
Max. Peak Voltage	32,000 volts
Max. RMS Current	28 amps.

VC12-20

Capacitance*	12 μμfd.
Max. Peak Voltage	20,000 volts
Max. RMS Current	28 amps.

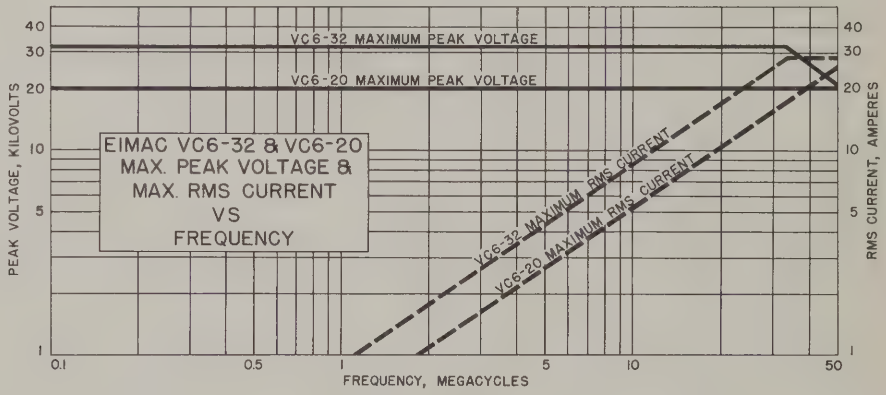


VC6-32

Capacitance*	6 μμfd.
Max. Peak Voltage	32,000 volts
Max. RMS Current	28 amps.

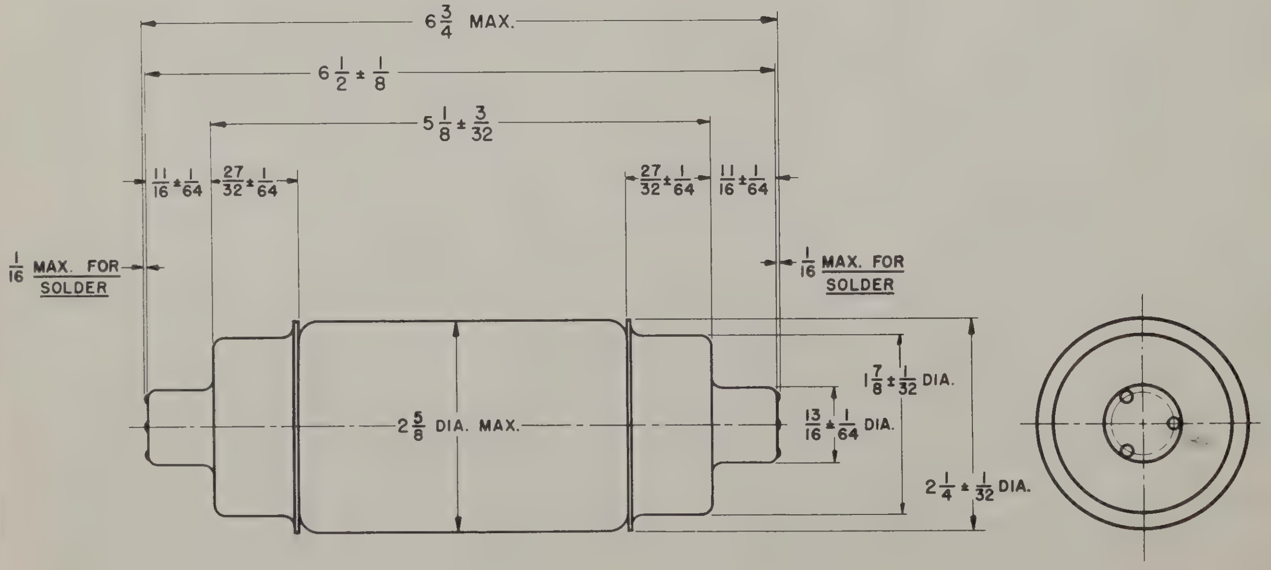
VC6-20

Capacitance*	6 μμfd.
Max. Peak Voltage	20,000 volts
Max. RMS Current	28 amps.



*Tolerances:
VC50-32, VC50-20 . . . . ± 1 μμfd.; VC25-32, VC25-20 . . . . ± 1 μμfd.; VC12-32, VC12-20 . . . . ± 1 μμfd.; VC6-32, VC6-20 . . . ± 0.5 μμfd.

▶



▶ Indicates change from sheet dated 4-1-46.

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

VARIABLE VACUUM CAPACITORS

TYPES VVC60-20 VVC2-60-20 VVC4-60-20

GENERAL

Eimac variable vacuum capacitors are intended principally for use as plate tank capacitors in radio frequency amplifiers and oscillators. The use of vacuum for the dielectric permits close spacing of the electrodes giving concentrated capacitance at high voltage. The variable vacuum capacitors are compact, lightweight, and eliminate the effects of dust and atmospheric conditions.

The basic capacitor unit (VVC60-20) has an RF peak voltage rating of 20,000 volts and a maximum current rating of 40 amperes RMS. Ganged multiple unit capacitors are available using two units (VVC2-60-20) or four units (VVC4-60-20). These multiple unit capacitors include a single mounting plate, gear train, and single tuning shaft. One end of each unit capacitor mounts on the common plate and one end is free. Thus the multiple capacitor may be connected with the units in parallel, as two series capacitors for "split-stator" work, or as multiple capacitors with one terminal common.

The capacitors may be operated at a maximum voltage rating at any frequency provided the current rating is not exceeded. Above a particular frequency the maximum current rating becomes the limitation and voltage values less than the maximum must be used. Curves are given for each capacitor showing maximum allowable current (RMS) vs. frequency.

The capacitance variation is linear with respect to shaft rotation with the complete range being covered in seventeen revolutions of the shaft. Reference should be made to the tuning curve for each capacitor. A return to previously-indexed settings is positive. The variable vacuum capacitors have a low temperature coefficient resulting in a negligible change in capacitance due to variation in temperature. The actual coefficient values are given for each capacitor combination.

MOUNTING

The VVC60-20 is provided with a mounting plate on one end, which also serves as an electrical connection. If the circuit is such that one side of the capacitor is grounded, the mounting plate can be fastened directly to the panel or chassis. Four eyelets to accommodate No. 8-32 machine screws are provided on the mounting plate. If a single or multiple unit is to be ungrounded the mounting should be on insulators and the tuning shaft broken with an insulating coupling and the dial portion of the shaft grounded.

The other end of the capacitor is provided with a large terminal that permits the use of a simple clamp or collet connector. This connector should be mounted flexibly to prevent undue mechanical strain being put on the capacitor seals. The connector must be kept clean and must at all times make a firm and positive contact with the capacitor terminal. Failure to maintain a low resistance contact to the capacitor terminal may result in excessive heating and permanent damage to the capacitor seals.

The multiple unit capacitor is designed so that it may be mounted readily on the chassis or from a panel. The mounting plate serves as one electrical connection and can be mounted directly at ground potential or insulated above ground.

The capacitors require normal circulation of air to keep the metal-to-glass seals below the maximum permissible temperature when carrying large values of current. In cases where the air flow is restricted or the ambient temperature is above room temperature a measurement of the seal temperature should be made. Adequate cooling must be provided to keep the metal of the metal-to-glass seals below 150° centigrade.

The low-torque tuning mechanism provides easy hand-operation of a dial directly on the shaft of either the single or multiple-unit capacitors. The capacity of type VVC vacuum condensers may be controlled by an electric tuning motor providing a minimum of two inch-pounds of torque per unit. The use of positive-action limit switches or a slip-coupling is recommended to avoid forcing the mechanism when it reaches the limit of its travel in either direction.

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VVC 60-20
VARIABLE VACUUM CAPACITOR

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

The VVC60-20 is a single unit variable vacuum capacitor.

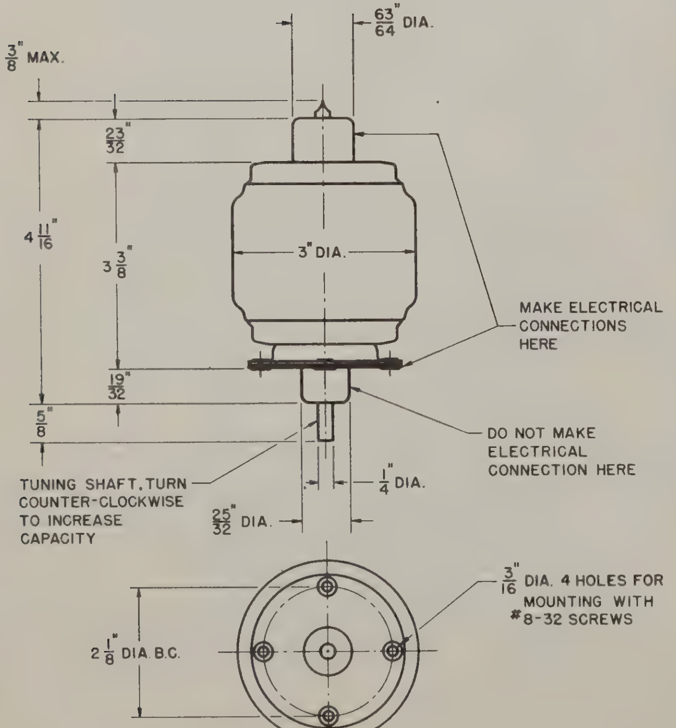
CHARACTERISTICS

ELECTRICAL

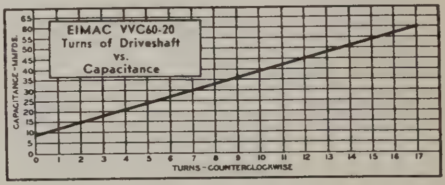
Capacitance	
Maximum	60 mmfd
Minimum	10 mmfd
Number of revolutions (See Curve)	17 turns
Maximum Peak R.F. Voltage	20 kilovolts
Maximum Current (RMS) (See derating curve vs frequency)	40 amperes
Temperature Coefficient	+.004 mmfd/°C

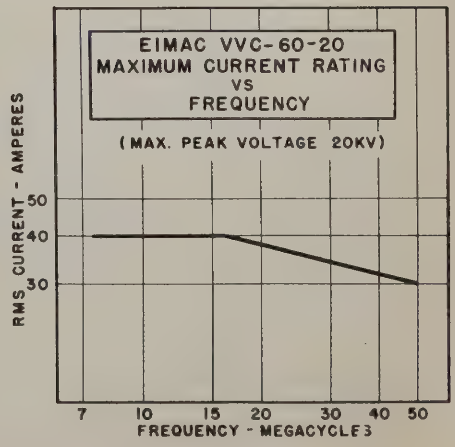
MECHANICAL

Mounting	See Outline Drawing
Cooling	Air Convection
Maximum Seal Temperature	150°C.
Maximum Overall Dimensions	
Length	5-11/16"
Diameter	3- 1/16"
Net Weight	1 lb. 6 oz.
Shipping Weight (average)	2 lb.



$\frac{63}{64}$" DIA.
$\frac{3}{8}$" MAX.
$\frac{23}{32}$"
4 $\frac{11}{16}$"
3 $\frac{3}{8}$"
3" DIA.
MAKE ELECTRICAL CONNECTIONS HERE
$\frac{19}{32}$"
$\frac{5}{8}$"
DO NOT MAKE ELECTRICAL CONNECTION HERE
TUNING SHAFT, TURN COUNTER-CLOCKWISE TO INCREASE CAPACITY
$\frac{1}{4}$" DIA.
$\frac{25}{32}$" DIA.
$\frac{3}{16}$" DIA. 4 HOLES FOR MOUNTING WITH #8-32 SCREWS
2 $\frac{1}{8}$" DIA. B.C.



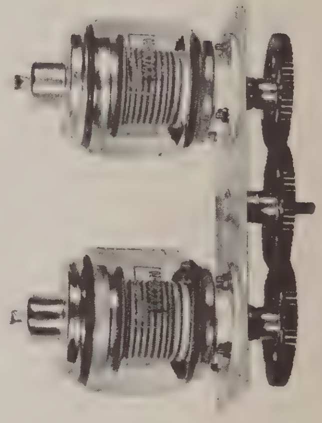


Effective 3-1-49

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

VVC2-60-20

VARIABLE VACUUM CAPACITOR



The VVC2-60-20 is a dual unit variable vacuum capacitor consisting of two VVC60-20 units in a convenient gang mounting.

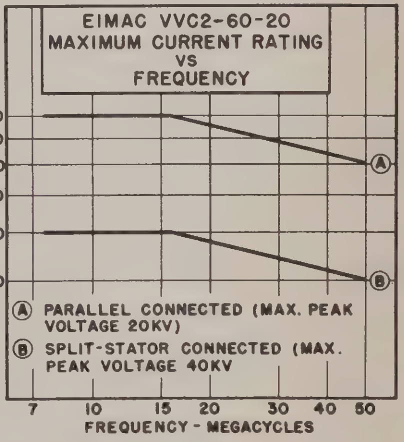
CHARACTERISTICS

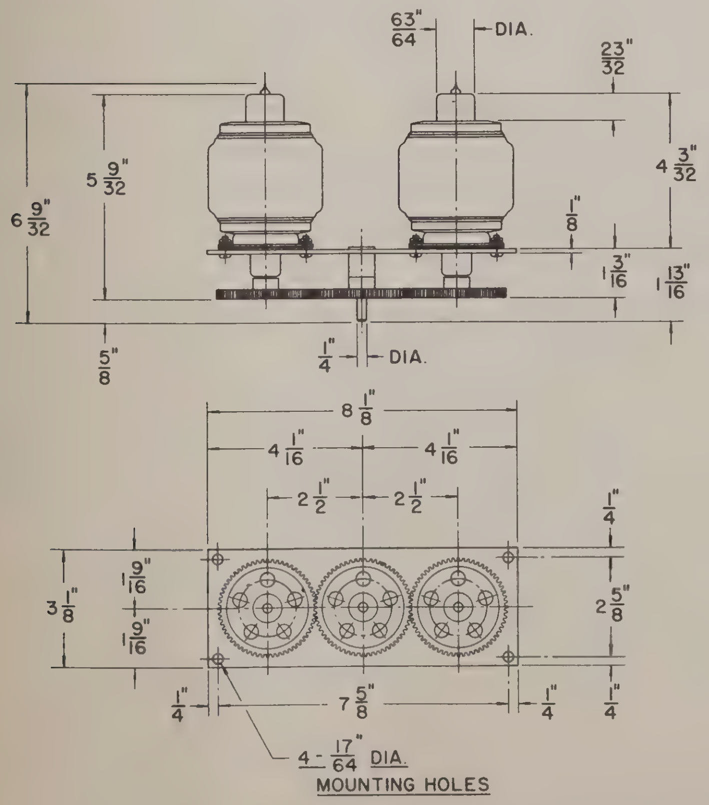
ELECTRICAL

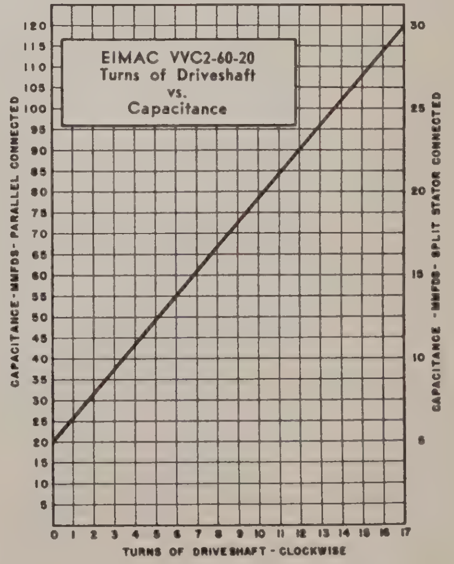
	Parallel	Split Stator	
Capacitance			
Maximum	120	30	mmfd
Minimum	20	5	mmfd
Number of revolutions (See Curves)	17	17	turns
Maximum Peak R.F. Voltage	20	40	kilovolts
Maximum Current (RMS) (See derating vs frequency)	80	40	amperes
Temperature Coefficient	+.008	+.002	mmfd/°C

MECHANICAL

Mounting	See Outline Drawing
Cooling	Air Convection
Maximum Seal Temperature	150° C
Maximum Overall Dimensions	
Depth	6-9/32"
Height	3-1/ 8"
Width	8-1/ 8"
Net Weight	4 lbs.
Shipping Weight (approx.)	8 lbs.



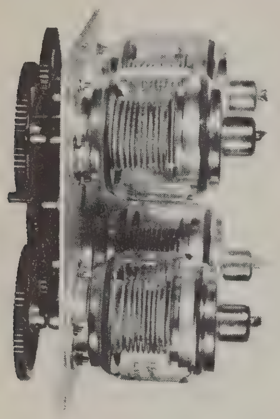




Effective 3-1-49

VVC4-60-20
VARIABLE VACUUM CAPACITOR

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA



The VVC4-60-20 is a four unit variable vacuum capacitor consisting of four VVC60-20 units in a convenient gang mounting.

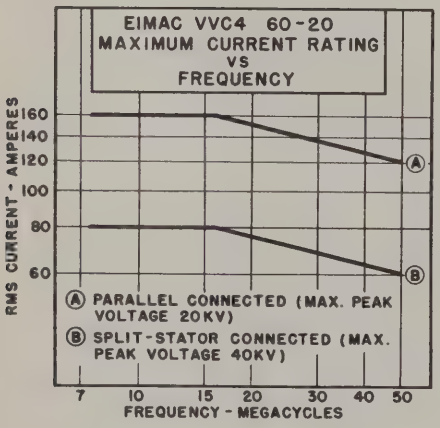
CHARACTERISTICS

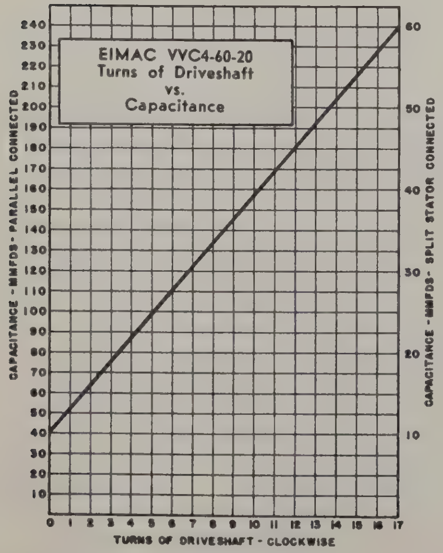
ELECTRICAL

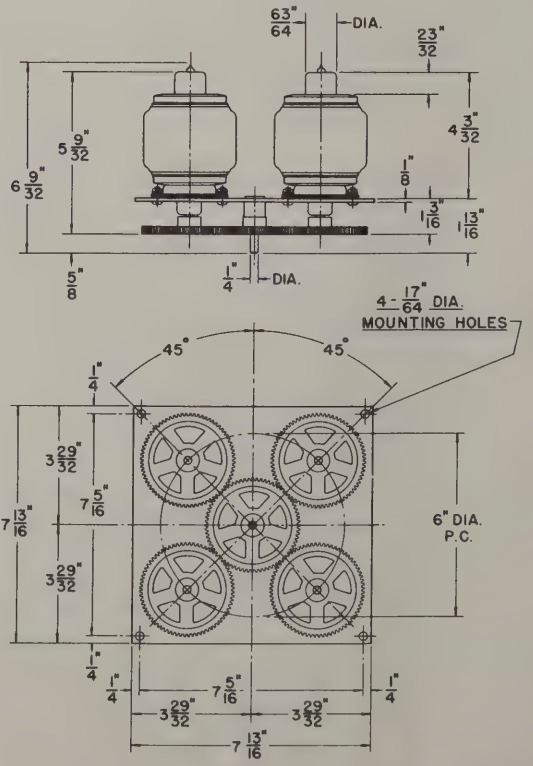
	Parallel	Split Stator	
Capacitance			
Maximum	240	60	mmfd
Minimum	40	10	mmfd
Number of revolutions (See Curves)	17	17	turns
Maximum Peak R.F. Voltage	20	40	kilovolts
Maximum Current (RMS) (See derating curve vs frequency)	160	80	amperes
Temperature Coefficient	+.016	+.004	mmfd/°C

MECHANICAL

Mounting	See Outline Drawing
Cooling	Air Convection
Maximum Seal Temperature	150°C
Maximum Overall Dimensions	
Depth	6- 9/32"
Height	7-13/16"
Width	7-13/16"
Net Weight	8 lbs.
Shipping Weight (approx.)	14 lbs.







Effective 3-1-49

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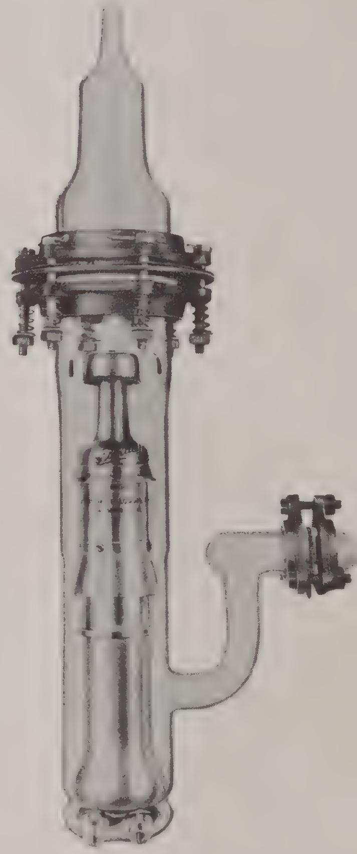
Eimac®

EITEL-McCULLOUGH, INC.
SAN CARLOS · CALIFORNIA

HV-1 DIFFUSION PUMP



The Eimac HV-1 Diffusion Pump is a fast, triple-jet, air-cooled vacuum pump of the oil-diffusion type. When used with a suitable mechanical forepump and a DC704 type oil it is capable of reaching an ultimate vacuum of 4×10^{-7} mm of mercury.

Assembly of the pump is a simple operation, requiring no special tools or intricate adjustments. It can be completely disassembled in five minutes or less.

The glass construction permits rapid inspection of conditions within the pump.

OPERATIONAL DATA

Amount of Oil	150 milliliters
Recommended Oil	DC704, Narcoil Octoil S.
Forepump Capacity*	0.1 to 2.0 liters per second at 0.001 mm of mercury, or less
Forepressure (maximum)	0.02 mm of mercury
Baffle Temperature	35° C or lower
Heater Voltage	100 to 110 volts
Heater Current (at 110 volts)	1.7 amperes
Speed, without baffle (approx.)*	67 liters per second at 4×10^{-4} to 4×10^{-6} mm Hg
Speed, with baffle (approx.)*	32 liters per second at 4×10^{-4} to 4×10^{-6} mm Hg
▶ Ultimate Vacuum, at 25° C (approx.)	10^{-6} mm Hg when using recommended oil.
▶ Using liquid N_2 Trap	10^{-7} mm Hg

MECHANICAL DATA

Casing	Pyrex Glass
Chimney	3 Jet, Aluminum
Cooling	Air
Maximum Overall Dimensions	See Outline Drawing
Mounting Position	Vertical, boiler down
Net Weight	6 pounds
Shipping Weight	18 pounds

* A small forepump may be used, but this will reduce the pumping speed at the higher manifold pressures.

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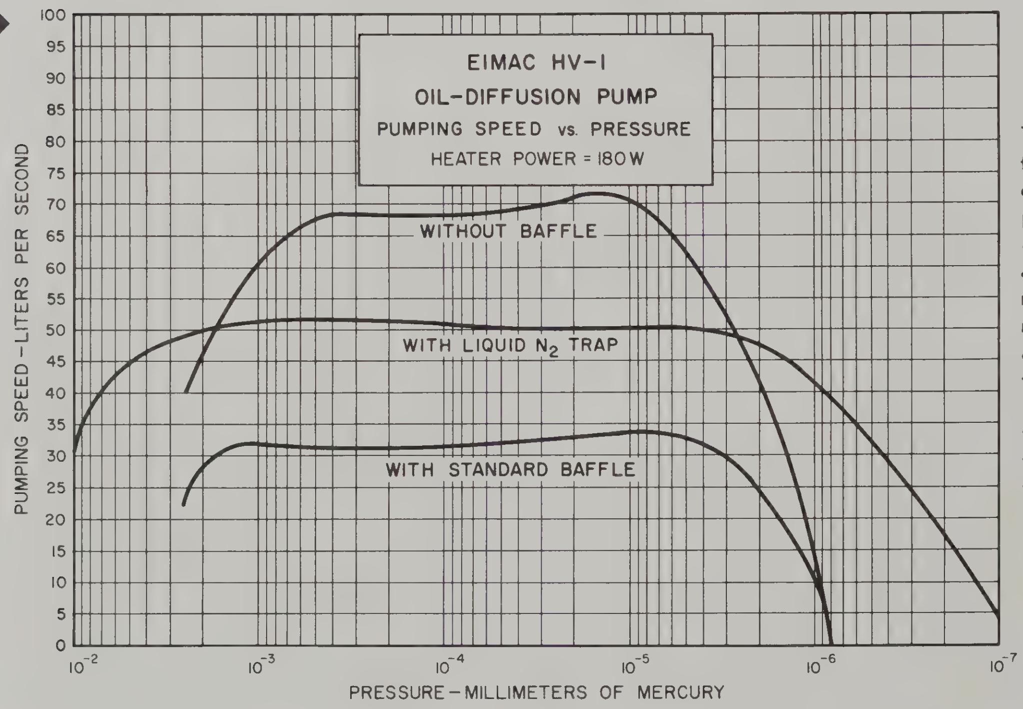
▶ Indicates change from sheet dated 8-29-53

OPERATION

▶ The principle upon which the oil-diffusion pump operates may be explained as follows. The drawing on page three illustrates the accepted theory. Gas to be removed from the high-vacuum system enters the pump at the top, and then into the region of the upper jet. Emerging from this jet is a stream of oil vapor which is generated by the electrically heated oil boiler at the bottom of the pump. Molecules of the unwanted gas diffuse into this stream of oil vapor and are carried down and out toward the cooler glass-wall of the pump. Upon reaching the glass-wall, the oil vapor condenses to a film of liquid oil which runs down the wall and returns to the boiler. The gas molecules are forced downward by the oil vapor and gas above them and come under the influence of the middle jet, where they are again forced down toward the bottom of the pump by a second stream of oil vapor.

▶



The curves at the left show the gas handling capabilities of the HV-1 over a range of pressures both with and without a baffle. These curves apply when a forepump with the required capacity is used. The rapid loss in pumping speed at the higher pressures is due to the inability of the forepump to handle the necessary volume of gas. With a larger forepump, the pumping speed would be maintained out to higher pressures.

The process of entraining the molecules of gas down toward the bottom of the pump is again repeated at the bottom jet. During pumping, as the manifold pressure drops, the amount of oil issuing from the lower jet is sufficient to form a visible ring of oil on the wall of the pump at a point well below the bottom skirt. In this region the concentration of gas is great enough to raise the pressure to a level which will allow a mechanical forepump to effectively remove the gas from the system.

To prevent small amounts of oil vapor from finding their way back into the high-vacuum side of the system, a baffle is often employed between the diffusion pump and the high-vacuum system. In the HV-1 this baffle is a pair of aluminum discs which are kept relatively cool by the pump cooling fan. Oil vapor reaching the baffle condenses and returns to the boiler. The baffle reduces the pumping speed by about one-half. This is well illustrated in the curves. Constrictions or bends in the system are to be avoided wherever possible. A short length of small-bore tubing can cause a considerable reduction in pumping speed.

Pumping speed is also affected by the capabilities of the forepump. The forepump must be able to remove the gas from the system while maintaining the required low pressure at its end of the diffusion pump.

Increased pumping speed may be obtained by operating several HV-1 units in multiple. The number of units which may effectively be used in multiple will be determined by the ability of the forepump to produce the required forepressure, and the ability of the manifold and tubulations to handle the desired pumping speed.

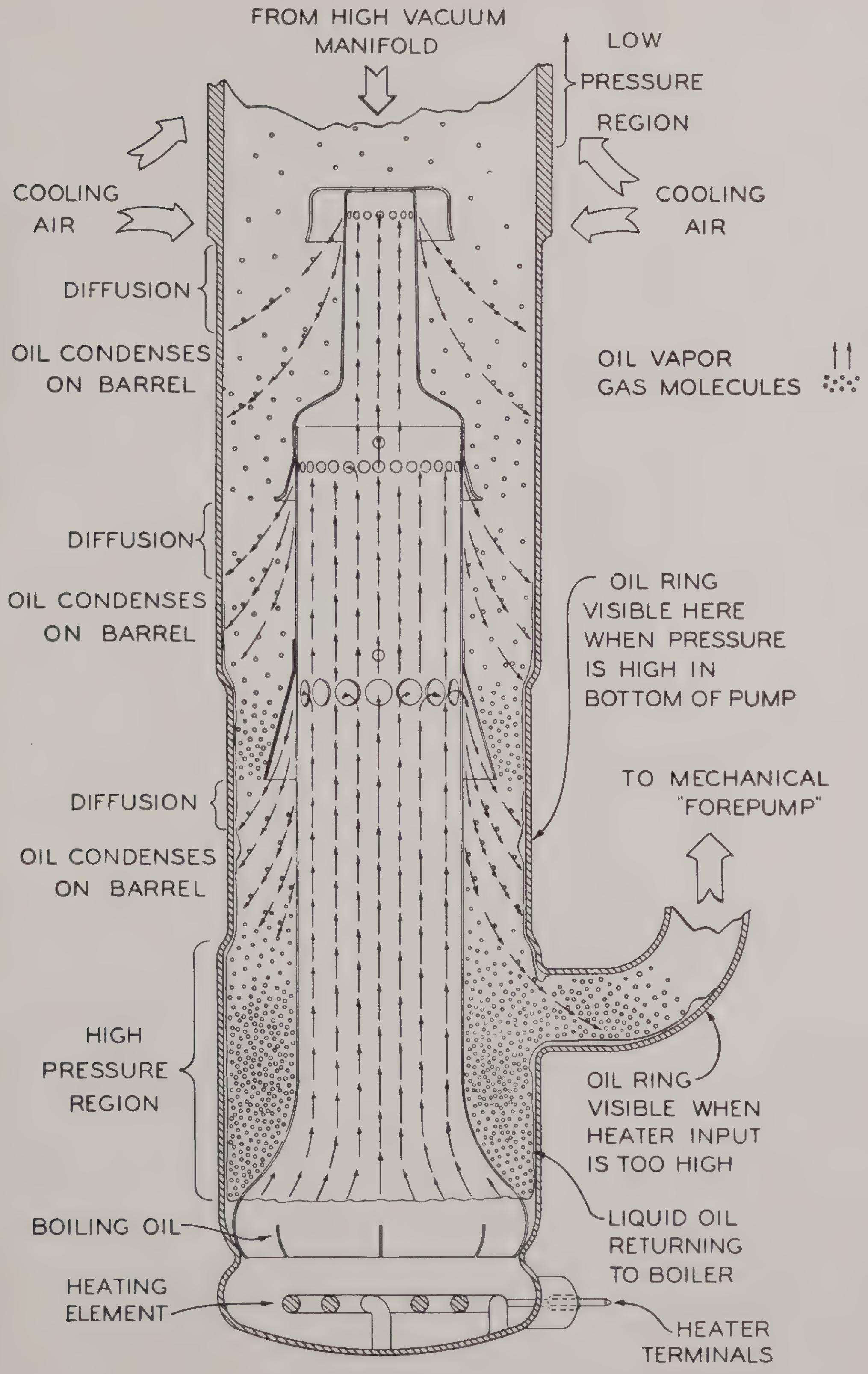
The HV-1 is capable of reaching an ultimate vacuum of $4 \text{ x } 10^{-7}$ mm of mercury or better when a liquid N_2 trap is used. To reach this low pressure, however, it is essential to avoid any contaminant in the high-vacuum system. Water, even in small amounts, or any hygroscopic matter should be carefully excluded. When so located as to be affected by heat, rubber is particularly objectionable, and a poor ultimate vacuum is likely to result if rubber gaskets are used in the diffusion pump. For this season, Neoprene gaskets are supplied with the HV-1.

In systems employing stop-cocks, valves or gaskets, it is necessary that the stop-cock, valve, or gasket lubricant have the minimum possible vapor pressure, because poor lubricants can easily destroy the high-vacuum capabilities of the pump.

APPLICATION

The HV-1 diffusion pump must be mounted securely, but not too rigidly. A satisfactory method of mounting consists of 1 X 1 X ⅛ inch angle shaped and drilled to pass four of the six spring loaded bolts used to join the large flanges at the top of the barrel (see illustration). When the desired manifold has been sealed to the manifold adapter (000914 on outline drawing), the pump is prepared for operation (after cleaning thoroughly as specified under **"CLEANING"**) in accordance with the following procedure:

▶ **Indicates change from sheet dated 8-29-53**


FROM HIGH VACUUM MANIFOLD
LOW PRESSURE REGION
COOLING AIR
COOLING AIR
DIFFUSION
OIL CONDENSES ON BARREL
OIL VAPOR
GAS MOLECULES
DIFFUSION
OIL CONDENSES ON BARREL
OIL RING VISIBLE HERE WHEN PRESSURE IS HIGH IN BOTTOM OF PUMP
TO MECHANICAL "FOREPUMP"
DIFFUSION
OIL CONDENSES ON BARREL
HIGH PRESSURE REGION
OIL RING VISIBLE WHEN HEATER INPUT IS TOO HIGH
LIQUID OIL RETURNING TO BOILER
BOILING OIL
HEATING ELEMENT
HEATER TERMINALS

1. Pour 150 milliliters of Diffusion Pump Oil into the pump barrel (000917).
2. Insert the aluminum jet assembly (004911) into the pump barrel.
3. Assemble the pump carefully, moistening both sides of each gasket with pump oil, or with a very fine layer of heavy-grade "Celvacene," or equivalent grease.
4. Install the pump in its mounting.

IMPORTANT: DO NOT START DIFFUSION PUMP HEATER UNTIL FOREPUMP IS IN OPERATION AND SYSTEM IS FREE OF LEAKS.

5. After making certain that the forepump is connected to the nipple (008911) through the suitable flexible coupling (vacuum-hose or vacuum type bellows), start the forepump motor. Check the manifold with a Tesla or other high-voltage high-frequency spark coil for leaks BEFORE CONTINUING.

   The Tesla coil, with a flexible wire probe, may be used to indicate the presence of leaks above the baffle. It is also valuable in estimating pressure in the manifold during the early stages of evacuation. **CAUTION:** too high a voltage may puncture the manifold at its weak points, i.e., where the glass may be very thin or at a seal-off tubulation. A rough indication for a suitable Tesla voltage is that which will produce a corona of about one-eighth inch on the end of a No. 14 B & S probe wire, visible in the dark only, and a stringy spark not over five-eights inch to a grounded metal surface.

   If the system is known to be free of leaks, the forepump and HV-1 may be started together. However, to protect the system and its oil, the manifold first should be checked with the Tesla coil with the HV-1 "off." When the cold oil stops bubbling and the pink glow is seen to be diminishing at a normal rate, the system may be assumed to be reasonably tight and the HV-1 may be started.

6. Connect the oil heater terminals via a switch to the source of power. The oil heater voltage should be set to between 100 and 110 volts for best results. An adjustable resistor or an auto transformer of the tapped or continuously variable type is recommended. The current at 110 volts is approximately 1.7 amperes.
7. The baffle assembly and upper end of the pump barrel should be kept cool (35° C or lower) by a small fan or blower (see illustration).

▶ **OIL**—The Eimac HV-1 is tested using a Silicon Oil, DC-704, to acquire the high-vacuum indicated in the specifications. DC-704 is water-white in color with a specific gravity of 1.07 at 25°C; it's flash-point is 410°F and the boiling point, for pressures of 5 to 10 microns of Hg, is 185°C. The ultimate vacuum attainable using DC-704 is on the order of 10^{-6} to 10^{-8} mm Hg. Although DC-704 is used to test the HV-1, any commercially available Diffusion Pump Oil, such as Narcoil, Octoil S, etc., is acceptable.

▶ **VACUUM GAGES**—To properly monitor the vacuum conditions at the manifold, a sensitive gage in the desired range is necessary. There are many systems used for this purpose, one of the most sensitive in high-vacuum systems being the Ionization (or Ion) gage. Its useful range extends from approximately 5 microns to a region in the upper experimental vacuum limits on the order of 10^{-6} microns (5×10^{-3} to 10^{-9} mm Hg). Recently, tubes and circuits have been developed which contribute to the high stability of this instrument. The Eimac type 100IG Ion Gage tube is designed to give the maximum internal leakage path, thus avoiding erratic readings due to possible contamination from the system.

LEAKS—If the system does not "clean-up" in a reasonable time, considering the nature and size of the manifold and connected chambers, a leak may be looked for by means of the Tesla coil. The probe should be run over the entire surface of the glass work involved. A "fast" leak will be indicated where sparks concentrate at a point on the glass and a pinkish glow takes place within the evacuated space.

Where a slow leak is suspected, before "bake-out"[1] and where the vacuum is high but still not satisfactory, a solvent such as carbon tetrachloride may be applied to the manifold surface, but not to the Neoprene gaskets, with an atomizer, a wad of cotton or brush. If a leak is found, the Tesla voltage will cause a marked bluish glow while the solvent is entering the aperture, or the ion gage reading will indicate increased pressure.

After "bake-out" or when the manifold is too hot for the application of liquids, illuminating gas or hydrogen may be applied to the surface from an unlighted torch. Gas entering the hole will effect the ionization gage reading immediately. A very small leak may be found in this way. If there are no leaks, the manifold and pump assembly is ready for use[2].

With the manifold at high vacuum, no ionization will be apparent from the effects of a Tesla probe held on the manifold (above the baffle). Below the baffle on the barrel of the HV-1 pump, the probe will cause fluorescene of the oil vapors as well as a visible disturbance of the oil flow below the jets. The probe when touched to the HV-1 outlet will show a faint, blue-violet glow. If these first two conditions are obtained, but a pinkish glow is present in the outlet, the mechanical pump and its coupling should be checked.

For new oil, or after an oil change, approximately 15 minutes heating time is required for the HV-1 to reach full efficiency from a cold start.

PRECAUTIONS

1. The vacuum system should not be opened "to air" when the diffusion pump is hot, to prevent oxidation of the pump oil.
2. If at any time a white vapor is visible in the HV-1, both pumps should be immediately shut off. The vapor is an indication of forepump failure or a very rapid leak. If the oil has become dark, the system may require complete cleaning.
3. Ground leads should be provided on both flange couplings to prevent the Tesla voltage from puncturing the Neoprene gaskets.

CLEANING

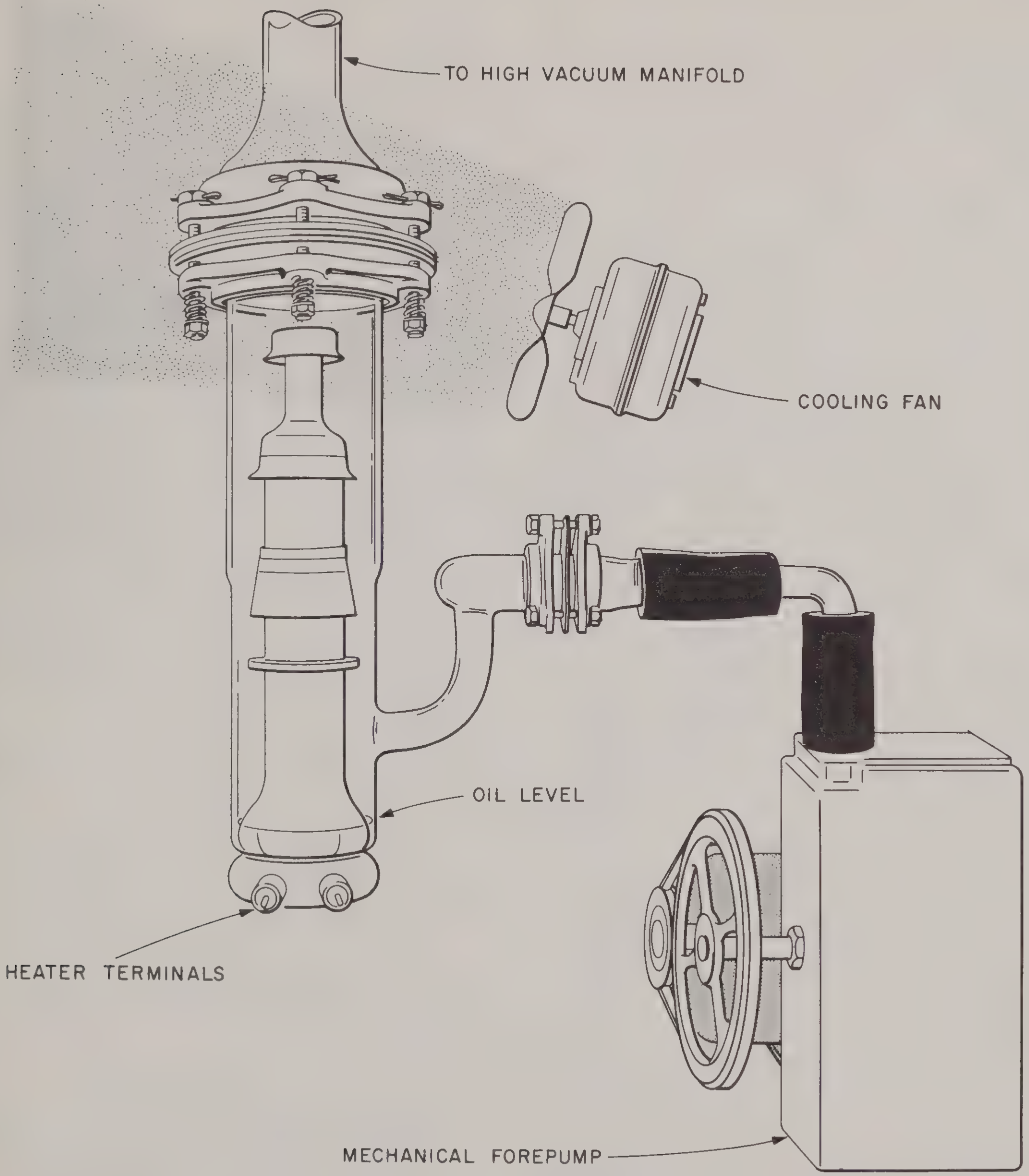
▶ Diffusion pumps in continuous use should be cleaned at approximately one-month intervals. The materials and facilities required for cleaning are: Trichlorethylene and pentane (or acetone). An oven capable of temperatures up to 500° C will allow complete removal of carbonaceous deposits. The oven should be provided with an air inlet and outlet to allow the products of oxidation to be carried off. An accurate temperature control and indicator are advisable to prevent mishap to the glass parts. Where an oven is not available, steel wool, water and some abrasive cleanser, such as diatomaceous earth, may be used. The procedure is given in the following paragraphs.

---

[1] "Bake-out" consists of surrounding the manifold and work to be evacuated with an oven. The temperature is then raised and held just under the annealing point for the "softest" glass being used in the system (approximately 500 degrees C for Pyrex). The temperature is maintained for thirty minutes to an hour, or at least until the new glass in the system shows no fluorescene on application of the Tesla voltage. This "cleans-up" the glass-ware to a point where it will not normally release further gas. An accurate thermocouple type temperature indicator and heater control are advisable to prevent mishaps to the system during "bake-out."

[2] Contamination in the system such as decomposed oil, or a source of high vapor pressure in the load will give "virtual leaks" or unfavorable maximum vacuum readings.

▶ Indicates change from sheet dated 8-29-53



▶ **GLASS HOUSING BARREL—**New housings should be given a rinse with a cup of pentane or acetone and then warm-air dried. (CAUTION: pentane and acetone are inflammable. Keep away from open flames.) Used, dirty housings should have the excess of oil fluid rinsed out with two or three flushings of about one cup (per rinse) trichlorethylene. The last rinse may be saved for the first wash of the following pieces. To remove adhering carbonaceous matter after draining, the housing should be baked out in an oven up to 500° C. If the housing is not too caked, a rinse with pentane or acetone and gentle drying with warm air (in place of baking out in the oven) is sufficient.

ALUMINUM JET ASSEMBLY—The jet assembly may be cleaned at the same time that the glass housing barrel is cleaned by inserting the assembly into the glass housing, pouring in the rinse solution and closing the top opening with a stopper. Agitate the solution by tilting and shaking the pump so that all parts are well washed over. Always remove the stopper and jet assembly after washing, prior to draining, baking or air drying. To further remove hard cabonaceous material, the assembly, less baffle, should be placed in an annealing oven and heated carefully to 475° C, then allowed to cool slowly in air.

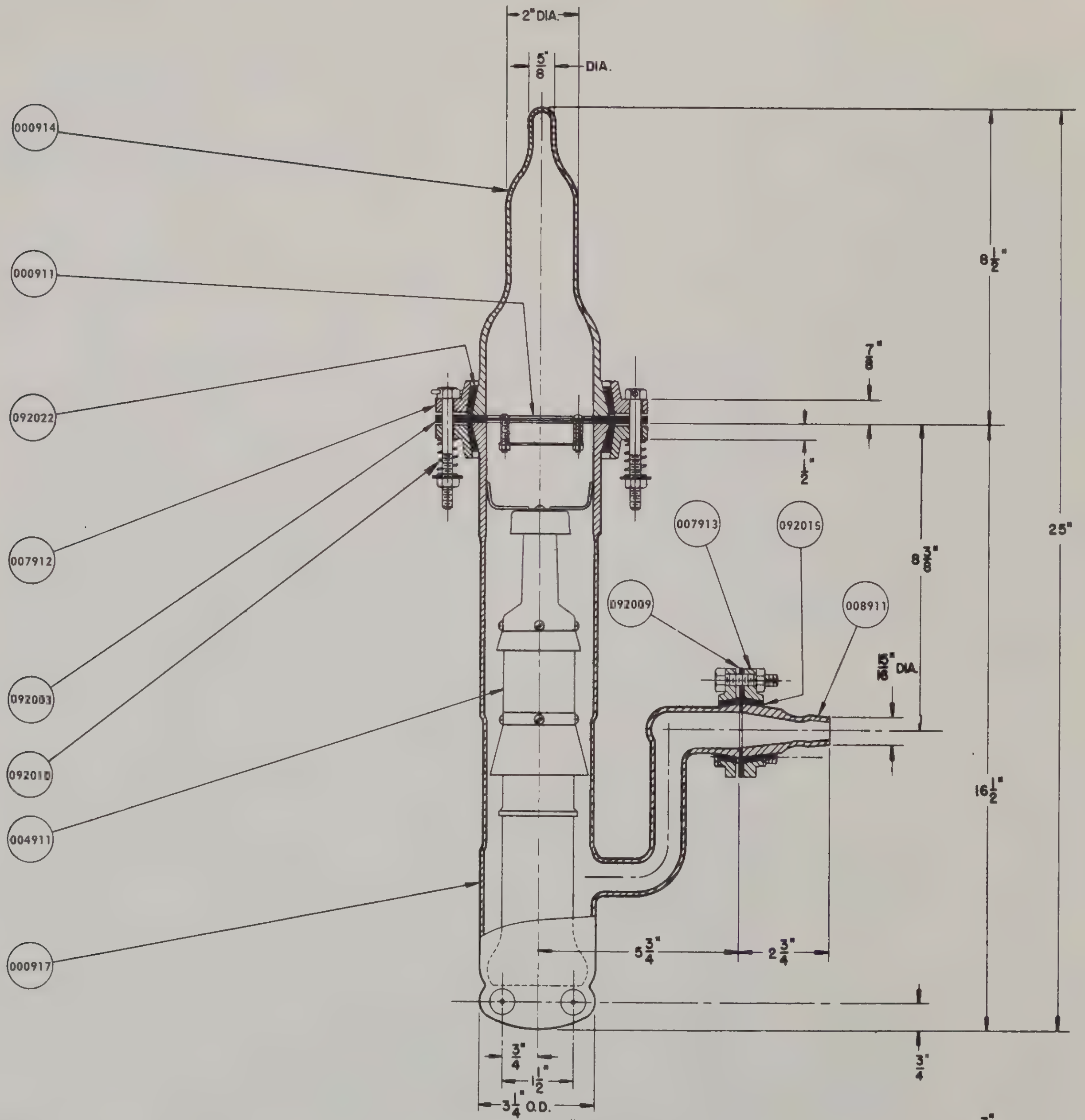
BAFFLE—The baffle should be disassembled and all parts rinsed three times with pentane or acetone; the last two rinsings must be with clean solution. Follow with warm-air drying.

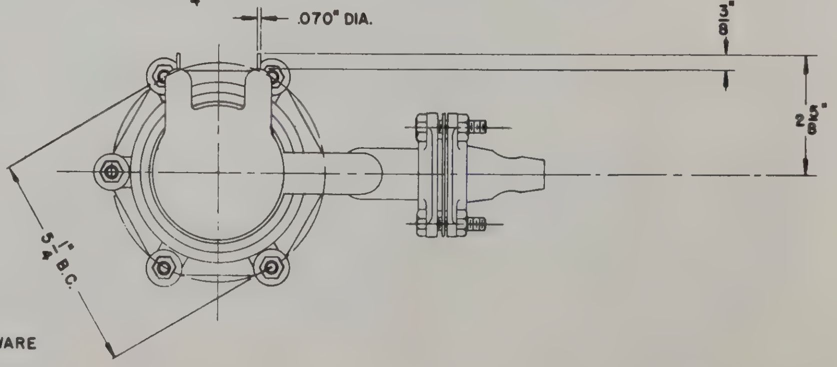
▶ **NEOPRENE GASKETS—**Wash the gaskets in pentane or alcohol, warm-air dry, then dry in oven at 110° C for 30 minutes.

GLASS MANIFOLDS—Use the same procedure as for the glass housing barrel when feasible. However, usually washing with pure water and alcohol, followed by warm-air drying, may be sufficient because there is less formation of carbonaceous matter here than in the case of the pump housing.

▶ Indicates change from sheet dated 8-29-53

▶ EIMAC HV-I DIFFUSION PUMP





PART NO.	NO REQ'D	ITEM
092003	2	NEOPRENE GASKET - 3" COUPLING
092009	1	NEOPRENE GASKET - 1" COUPLING
092010	6	SPRINGS
092015	2	1" INSERT
092022	2	3" INSERT
000911	1	BAFFLE ASSEMBLY
000914	1	MANIFOLD ADAPTOR
000917	1	PUMP BARREL ASSEMBLY
004911	1	JET ASSEMBLY
007912	1	3" METAL FLANGE ASSEMBLY *
007913	1	1" METAL FLANGE ASSEMBLY *
008911	1	FORE-VAC NIPPLE

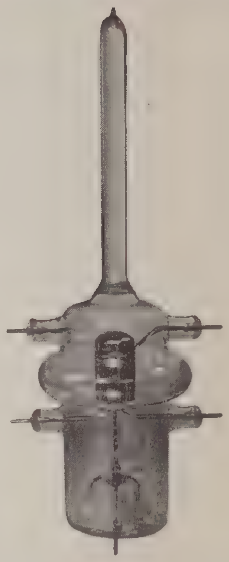
* EACH FLANGE ASSEMBLY INCLUDES NECESSARY FLANGES, GASKETS, INSERTS, BOLTS AND HARDWARE

▶ Indicates change from sheet dated 8-29-53

Printed in U.S.A. 640

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

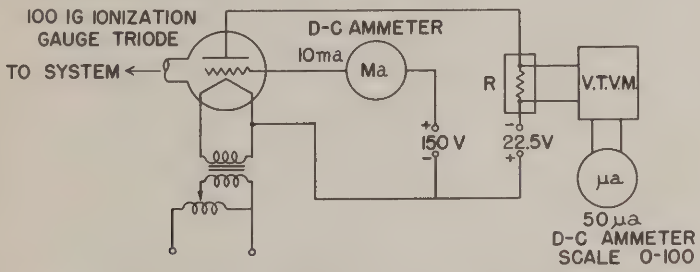
100 IG
IONIZATION GAUGE TRIODE



The Eimac 100 IG ionization gauge is designed for use in high vacuum exhaust systems, and will measure pressures from approximately 10^{-3} millimeters of mercury to less than 10^{-8} millimeters of mercury. The Nonex glass envelope can be sealed directly to exhaust systems employing Nonex or Kovar-sealing glass and can be sealed to Pyrex by means of a graded seal.

The 100 IG is a triode vacuum tube consisting of a pure tungsten filament and molybdenum grid and plate. No insulators are used within the tube, and the envelope is designed to provide long leakage paths between the plate and other tube elements.

Positive ion current indications are obtained with either a sensitive galvanometer or a vacuum tube amplifier. A typical circuit employing an Eimac 100 IG ionization gauge triode and a vacuum tube voltmeter is shown below.



The filament temperature of the 100 IG must be low enough so that the emission is temperature-limited. With a good vacuum, the filament voltage will be between 2.0 and 4.0 volts, and the filament current will be approximately 8.0 amperes. With a poor vacuum, it will be necessary to increase the filament voltage to approximately 7.5 volts, and the current will be about 12 amperes. (The tube should not be operated long at high filament voltage.)

CAUTION: Filament voltage should not be applied until vacuum has been obtained as indicated by a spark coil glow test.

If grid voltage is obtained from a rectified a-c power supply and if the line voltage is not stable, it will be desirable to employ a gaseous regulator tube. A positive voltage of 150 volts with respect to the filament and current of 5 milliamperes is standard for the 100 IG.

The recommended plate voltage is -22.5 volts with respect to the filament. A plate voltage from -20 to -45 volts will give satisfactory operation, but plate voltages of 0 to -20 volts will result in low and incorrect plate currents.

In order to fully realize the capabilities of the 100 IG, it will be necessary to make "R" in the above figure variable. One circuit that has been employed with success is a group of 6 resistors and a rotary switch arranged so that only one resistor is across the input to the vacuum tube voltmeter at a time. By selecting resistors that increase by a factor of 10, the 0-100 scale microammeter will change calibration by the same factor, and will be convenient to read. With resistance values of 500, 5K, 50K, 500K, 5 megohms and 50 megohms, the maximum (full scale meter deflection) input voltage to the vacuum tube voltmeter will be ½ volt.

The calibration of the gauge depends upon the composition of the gas in the system. For dry air the pressure is given by the following formula:

Pressure (mm. of Hg) $= I_p \, (3.3 \times 10^{-5})$
where Ip . . . . = Plate current in microamperes
when Grid Voltage . = +150 volts
Grid Current . . . = .005 amperes
Plate Voltage . . = -22.5 volts

A bake-out of the tube at 450° Centigrade and outgassing of the tube elements is necessary whenever the exhaust system has been opened to air or the elements need cleaning. Outgassing is accomplished by heating the grid and plate to a dull cherry red by either r-f induction or by direct electron bombardment. Recommended outgassing voltages for the 100 IG are as follows:

Filament Outgassing Voltage (approximately)	8 volts
Plate Outgassing Voltage	800 volts
Plate Outgassing Current	120 ma

The grid and a 1000 ohm resistor is placed in series with the plate during outgassing. The recommended outgassing time is approximately five minutes, or until the pressure in the exhaust system has become stabilized.

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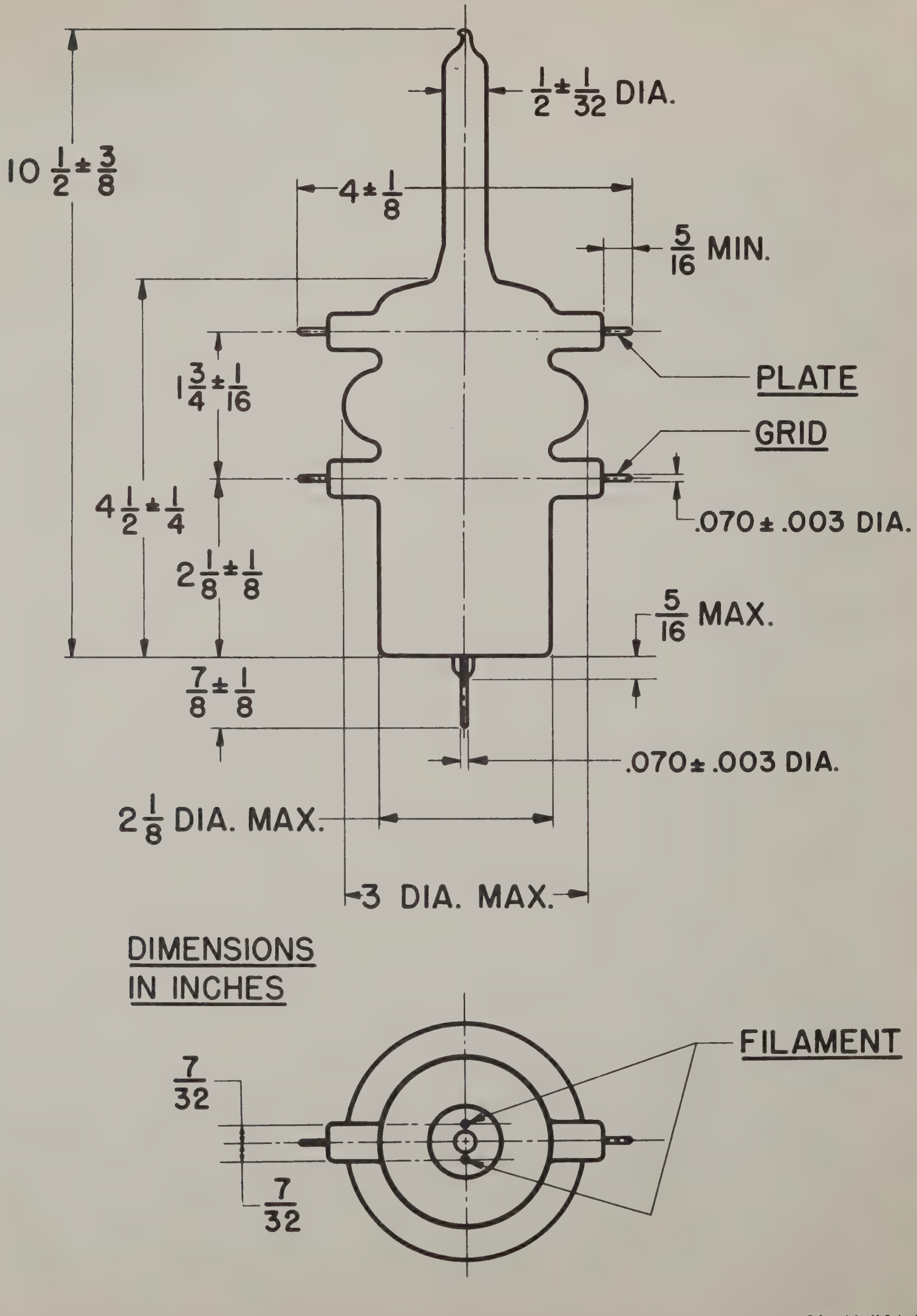
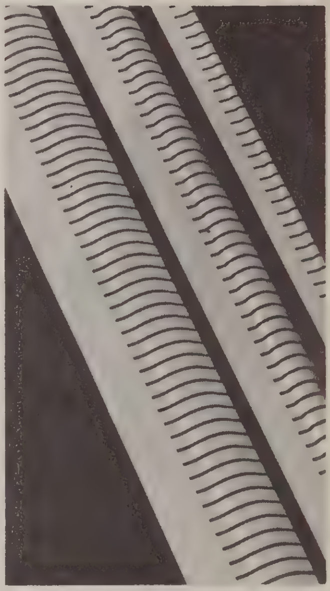

1/2 ± 1/32 DIA.
10 1/2 ± 3/8
4 ± 1/8
5/16 MIN.
PLATE
1 3/4 ± 1/16
GRID
4 1/2 ± 1/4
.070 ± .003 DIA.
2 1/8 ± 1/8
5/16 MAX.
7/8 ± 1/8
.070 ± .003 DIA.
2 1/8 DIA. MAX.
3 DIA. MAX.
DIMENSIONS IN INCHES
FILAMENT
7/32
7/32

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

PREFORMED
CONTACT
FINGER
STOCK

PREFORMED CONTACT FINGER STOCK



▶ Eimac Preformed Contact Finger Stock is a prepared strip of spring material slotted and formed into a series of fingers designed to make sliding contact.

Eimac Finger Stock is an excellent means of providing good circuit continuity when using components with adjustable or moving contact surfaces. It is especially suitable for making connections to tubes with coaxial terminals, or to moving parts, such as long-line and cavity type circuits; and it is also useful in acting as an electrical "weather-strip" around access doors to equipment cabinets.

The material is a heat treated alloy; and is silver plated for better r-f conductivity. No further forming of the material should be attempted. Eimac Finished Finger Stock has a minimum radii of curvature of ½" for the 17/32" type, and ¾" for both the 31/32" and 1-7/16" types. It may be secured by any suitable mechanical means or by soft soldering.

Eimac Finger Stock can be obtained to order in a raw state (punched, formed, unplated and not heat treated). The Raw Finger Stock can be formed to different shapes by the user but it then must be carefully heat treated. Finished Finger Stock receives a closely controlled and uniform heat treatment as follows: 375°-385°C. for 5 hours in a neutral gas atmosphere. No special cooling considerations are necessary, except those required to avoid oxidation. Eitel-McCullough will not undertake to heat treat or plate Raw Finger Stock after being further formed by a customer. For further information concerning the heat treatment of the Finger Stock material, Alloy No. 720, write the supplier of the material:

General Plate Division
Metals and Control Corporation
Attleboro, Massachusetts

Standard lengths of either Raw or Finished Finger Stock are 1 foot, 2 feet and 3 (maximum) feet. Some small variation about the standard lengths should be expected.

▶

Eimac Tubes and Contact Surfaces for which Finger Stock is especially suitable.	PLATE	GRID	SCREEN GRID	CATHODE
3W10,000A3	**1-7/16**	**31/32**		**17/32**
3W5000A3	**1-7/16**	**17/32**		
3W5000F3	**1-7/16**	**17/32**		
3X3000A1	**1-7/16**	**17/32**		
3X3000F1	**1-7/16**			
3X2500A3	**1-7/16**	**17/32**		
3X2500F3	**1-7/16**			
4X500A	**31/32**		**31/32**	
4X500F	**31/32**			
4X150A	**17/32**		**17/32**	
4X150D	**17/32**		**17/32**	
4X150G	**17/32**		**17/32**	
2C39A	**17/32**			

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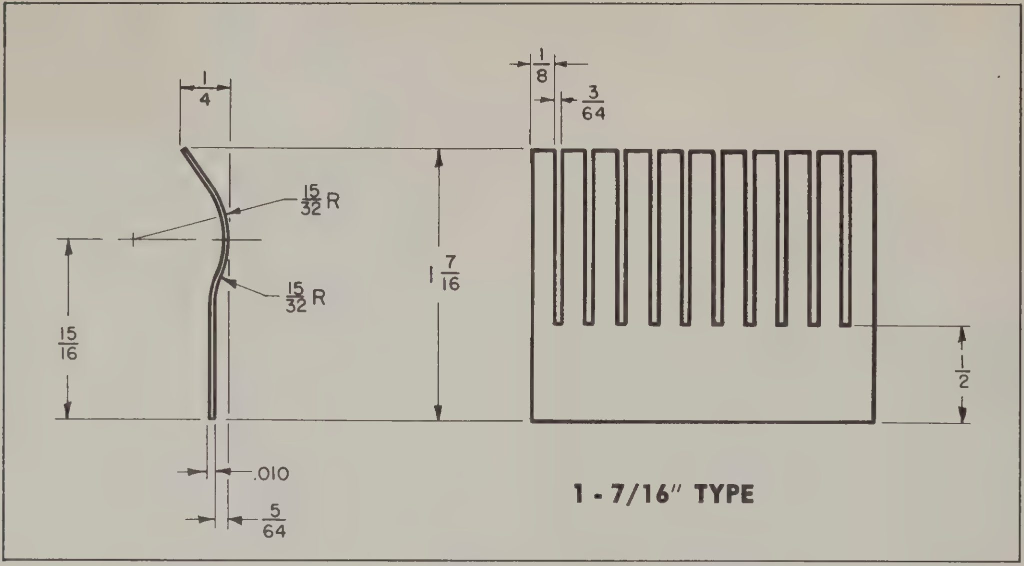
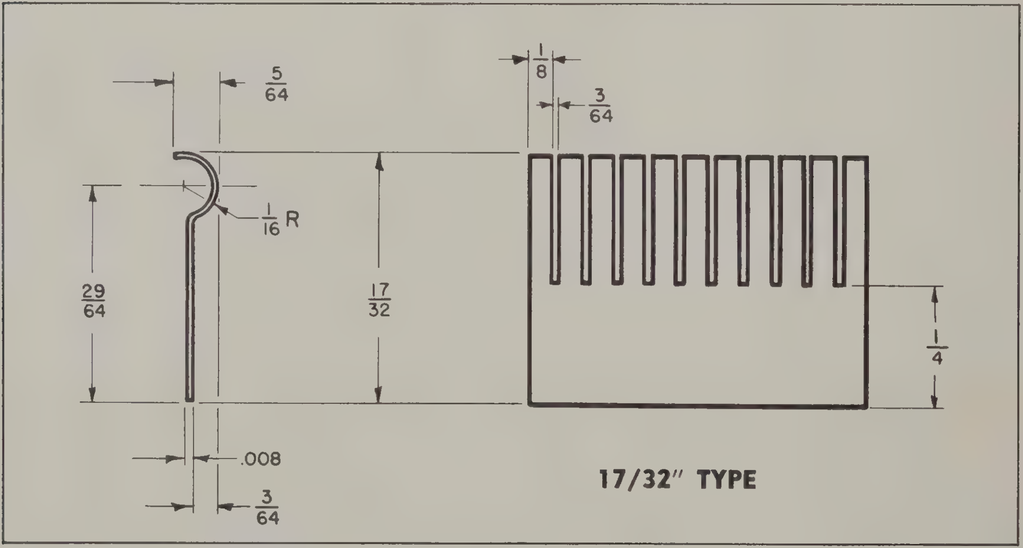
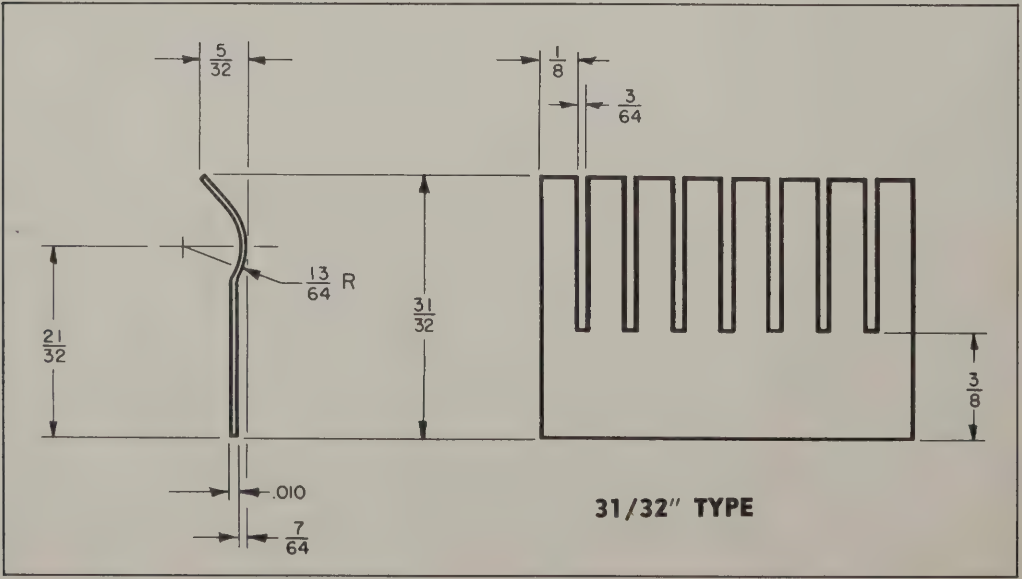
▶



1 - 7/16″ TYPE



17/32″ TYPE



31/32″ TYPE

NOTE—The above dimensions should be regarded as carrying normal manufacturing tolerances because of variations in the shearing, forming and heat-treating processes.

▶ Indicates change from sheet dated 9-15-51.

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

HR HEAT DISSIPATING CONNECTORS

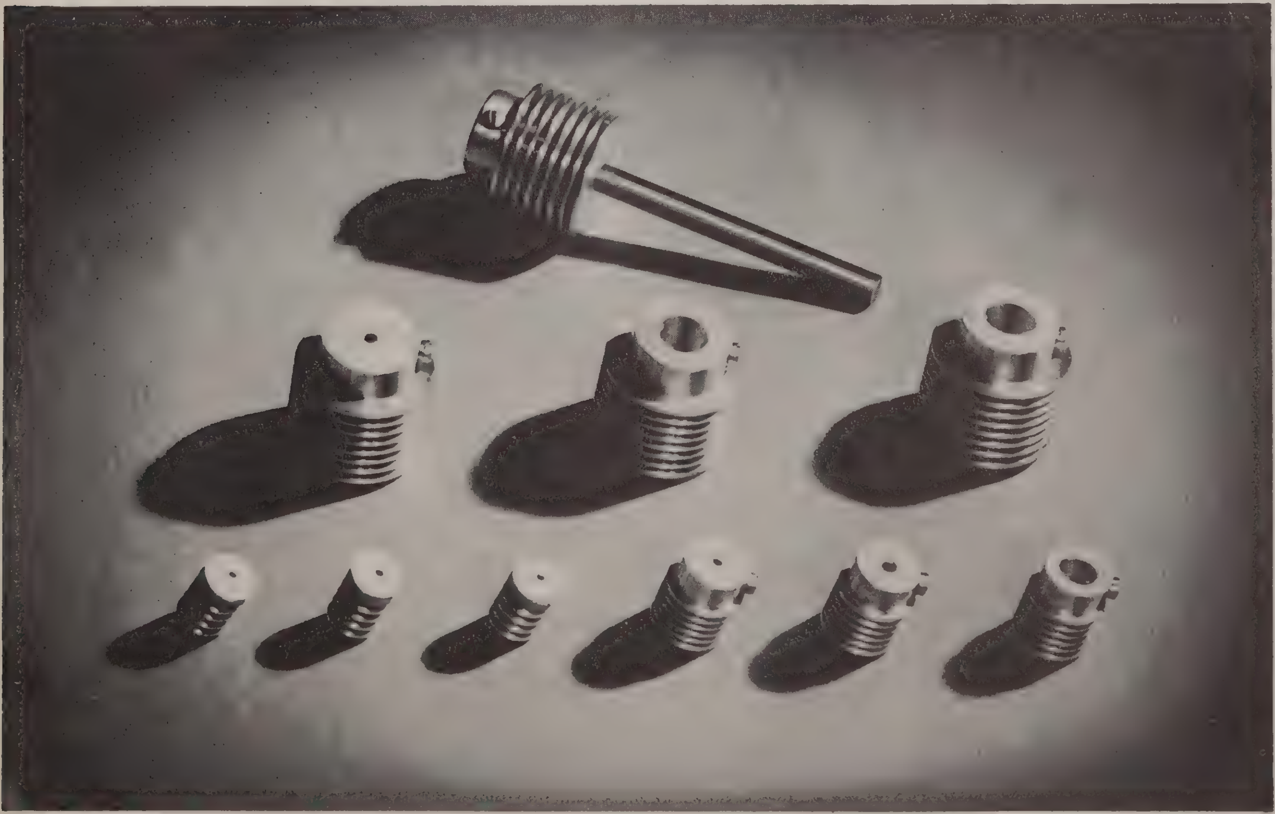
Eimac HR Heat Dissipating Connectors are used to make electrical connections to the plate and grid terminals of Eimac tubes, and, at the same time, provide efficient heat transfer from the tube element and glass seal to the air. The HR connectors aid materially in keeping seal temperatures at safe values. However, it is sometimes necessary to forced-air-cool the connector by means of a small fan or blower. In such cases the air flow should be parallel with the fins of the connector.

Designed for use on the larger tubes, the HR-9 Heat Dissipating Connector is provided with an air duct to conduct the cooling air directly to the glass seal.

HR Heat Dissipating Connectors are machined from solid dural rod, and are supplied with the necessary machine screws. The table below lists the proper connectors for use with each Eimac tube type.

TUBE	PLATE CONNECTORS	CONNECTOR GRID
2-25A	HR-1	....
2-50A	HR-3	....
2-150D	HR-6	....
2-240A	HR-6	....
2-2000A	HR-8	....
3C24	HR-1	HR-1
4-65A	HR-6	....
4-125A	HR-6	....
4-250A	HR-6	....
4-400A	HR-6	....
4-1000A	HR-8	....
▶ 4E27A/5-125B	HR-5	....
▶ 4PR60A	HR-8	....
▶ 6C21	HR-8	HR-8
KY21A	HR-3	....
RX21A	HR-3	....
25T	HR-1	....
35T	HR-3	....
35TG	HR-3	HR-3
UH50	HR-2	HR-2
75TH-TL	HR-3	HR-2
100R	HR-8	....
100TH-TL	HR-6	HR-2
VT127A	HR-3	HR-3
152TH-TL	HR-5	HR-6
250TH-TL	HR-6	HR-3
250R	HR-6	....
253	HR-8	....
304TH-TL	HR-7	HR-6
327A	HR-4	HR-3
450TH-TL	HR-8	HR-8*
▶ 592/3-200A3	HR-10	HR-5
750TL	HR-8	HR-8
866A	HR-8	... .
872A	HR-8	....
1000T	HR-9	HR-9
▶ 1500T	HR-8	HR-8
▶ 2000T	HR-8	HR-8

*The grid terminal of the 450TH-TL type tube is now .560" in diameter. To accommodate existing equipment designed for the older style 450TH-TL having .098" diameter grid terminals, an adapter pin is provided with the newer tubes. This adapter pin is threaded so that it may be removed from the grid terminal of the tube. The small grid terminal requires an HR-4 connector.



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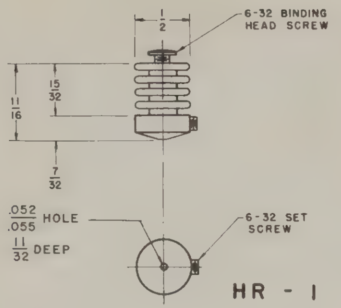
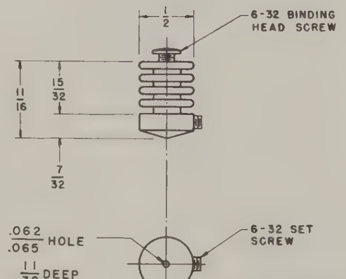
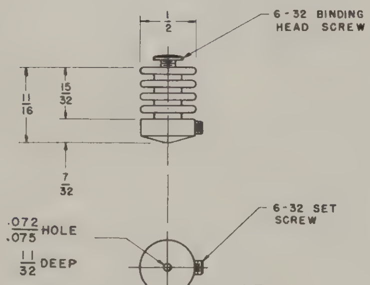
▶ Indicates change from sheet dated 7-1-50



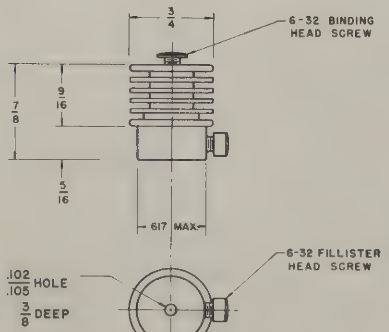
HR - 1



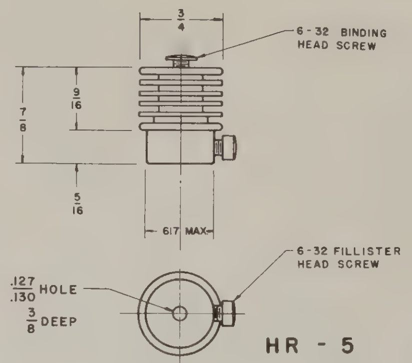
HR - 2



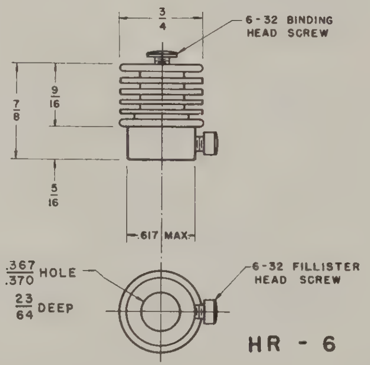
HR - 3



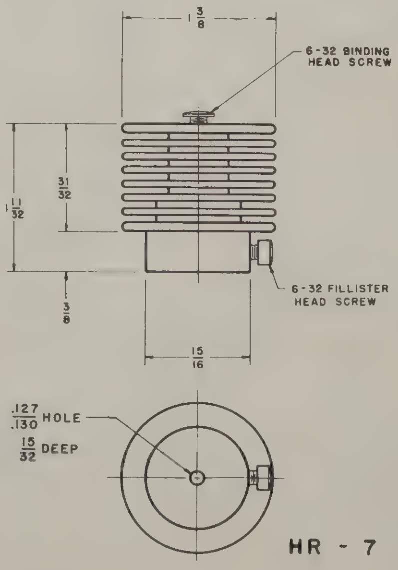
HR - 4



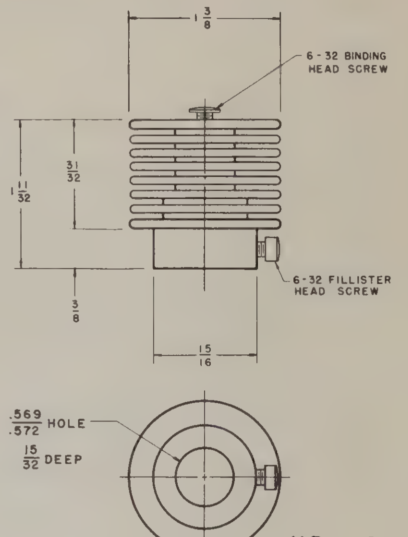
HR - 5



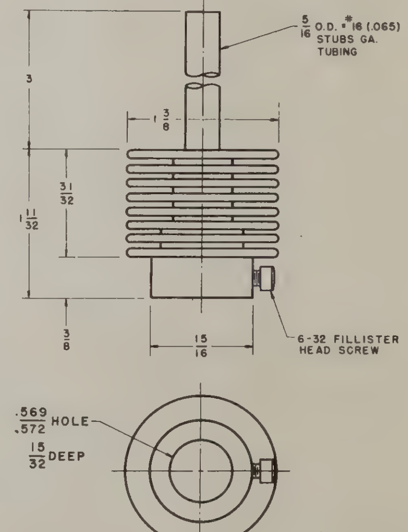
HR - 6



HR - 7

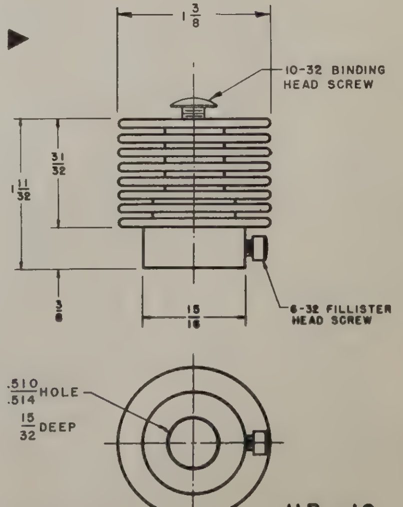


HR - 8


5/16 O.D. #16 (.065) STUBS GA. TUBING
3
1 3/8
31/32
1 11/32
3/8
15/16
6-32 FILLISTER HEAD SCREW
.569/.572 HOLE
15/32 DEEP

HR - 9

▶



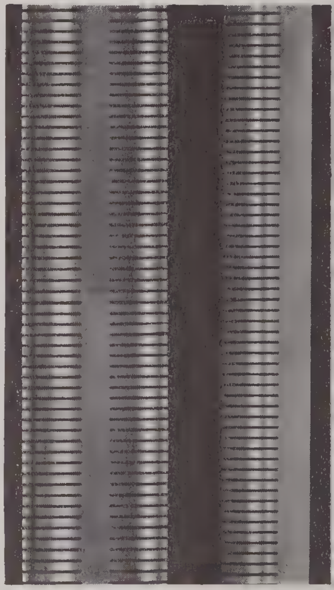
HR - 10

▶ Indicates change from sheet dated 7-1-50

Eimac®

EITEL-McCULLOUGH, INC.
SAN CARLOS · CALIFORNIA

PREFORMED CONTACT FINGER STOCK



PREFORMED CONTACT FINGER STOCK

Eimac Preformed Finger Stock is a prepared strip of spring material, slotted and formed into a series of fingers, designed to make a sliding contact.

Eimac Contact Fingers are an excellent means of providing good circuit continuity when using components with adjustable or moving contact surfaces. It is especially suitable for making connections to tubes with coaxial terminals or to moving parts, such as long line and cavity type circuits. It is also useful as an electrical "weather strip" around access doors in equipment cabinets.

The base material is a non-ferrous spring alloy, heat treated for more positive spring action and silver plated for better r-f conductivity. No further forming of the material should be attempted. The minimum radius of curvature for the material is ¾". It may be secured by any suitable mechanical means or by soft soldering. If torch-soldering is attempted extreme care must be exercised to prevent overheating which will anneal the material with subsequent destruction of the spring qualities.

The material is heat treated to a hardness of 91 to 94 as measured on the 15 T scale of a superficial hardness tester. These values correspond, approximately, to a Rockwell B hardness of 93 to 100.

Eimac Contact Finger Stock is available (on special factory order) in the following semi-finished states: (a) slotted and formed but not heat treated or silver plated, (b) slotted, formed and silver plated but not heat treated or (c) slotted, formed and heat treated but not silver plated. Orders for these semi-finished materials should specify the state of completion desired. Such orders should allow approximately ninety days for completion since these semi-finished materials are not carried in stock. Contact Finger Stock which has not been heat treated can be formed to different shapes by the user, after which it may be heat treated. Eitel-McCullough can not undertake to heat treat or plate semi-finished Contact Finger Stock after being further formed by a customer. When the unhardened material is ordered and heat treatment is to be undertaken after further forming, the user should request heat treating information when placing the order.

Standard lengths of the finished or semi-finished material are one foot, two feet and a maximum length of three feet. Some small variations in these lengths should be expected.

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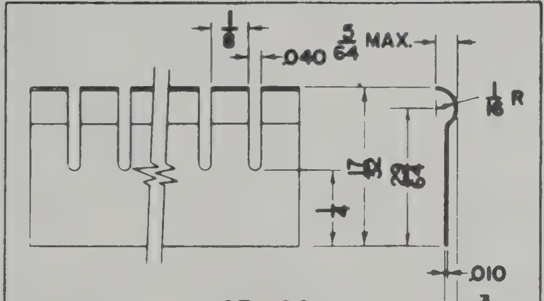
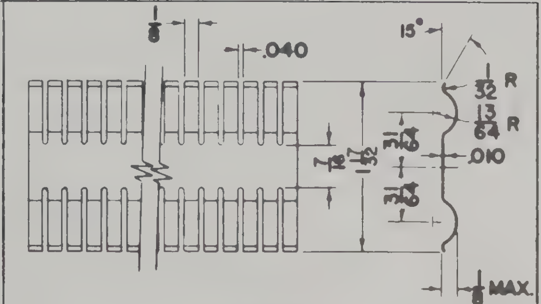
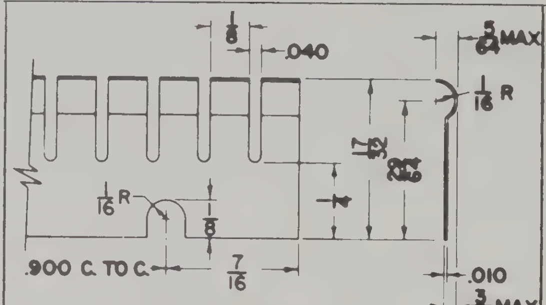


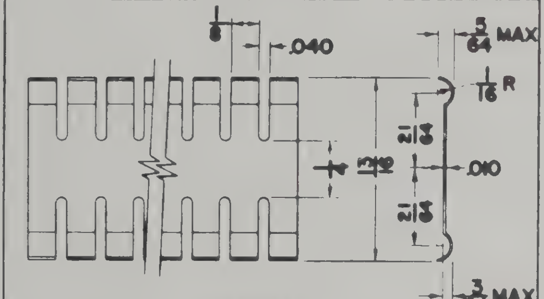
CF-100



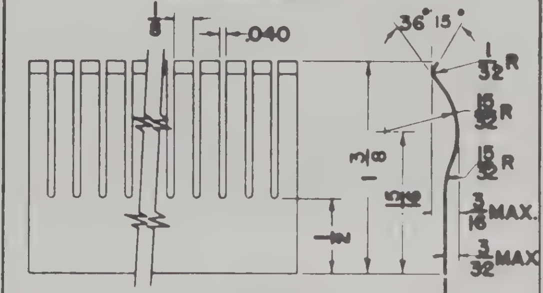
CF-400



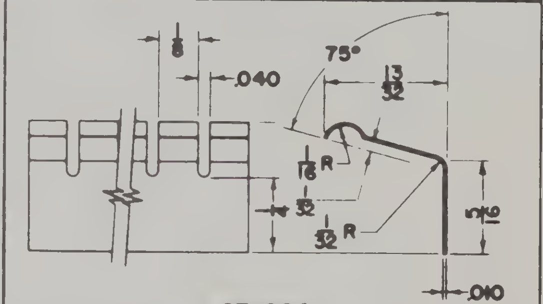
CF-700



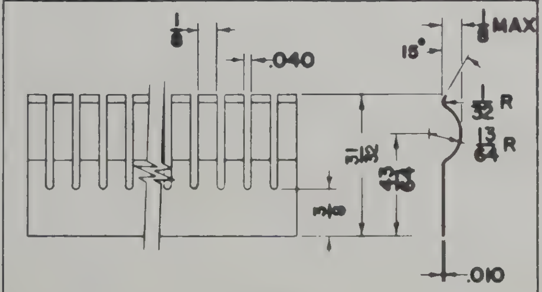
CF-200



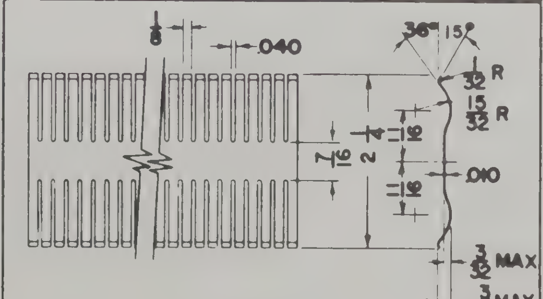
CF-500



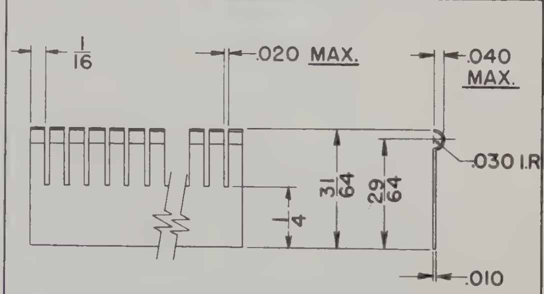
CF-800



CF-300



CF-600



CF-900

NOTE—The above dimensions should be regarded as carrying normal manufacturing tolerances because of variations in the shearing, forming and heat-treating processes.

▶ Indicates change from sheet dated 10-1-56.

EITEL-McCULLOUGH, INC.
SAN CARLOS · CALIFORNIA

SK-800A

AIR-SYSTEM SOCKET UNGROUNDED CATHODE TERMINALS

SK-806

AIR CHIMNEY

SK-800A

SK-800A WITH CHIMNEY

The Eimac SK-800A is one of the air-system sockets recommended for use with the Eimac 4CX1000A or 4CW2000A tetrodes. A companion SK-806 Air Chimney is also available and is recommended for use with the socket when the air-cooled 4CX1000A is to be employed.

When this socket is used, connection is made to each of the tube electrodes, except the anode, and to one side of the integral screen-grid by-pass capacitor. The SK-800A is humidity and salt-spray resistant.

BASE CONNECTIONS

The SK-800A socket consists of three sets of spring-finger contacts for each tube electrode (to assure low-inductance contact), a center guide pin to facilitate tube installation, and an integral screen by-pass capacitor. The terminals are shown on the outline drawing.

When the socket is mounted on a grounded chassis, no tube electrodes are automatically grounded. Connection to the cathode and one side of the heater is made via the second set of spring-finger contacts from the bottom of the socket.

SCREEN-GRID BY-PASS CAPACITOR

This capacitor utilizes polyester film as a dielectric and is encapsulated in epoxy resin. Its capacitance is 1500 uufds ±20 percent and it is rated at 400 d-c working volts. One side connects to the three screen-grid tabs on the tube and the other side is connected directly to the socket body.

MATERIALS & FINISHES

The metal shell, or body, of the socket is fabricated of silver-plated brass, while the mounting base and centering pin are of nickel-plated brass. All contacts are formed of a non-ferrous alloy, heat-treated and silver-plated. Contact insulating material is high-temperature ceramic.

INSTALLATION

The SK-800A Air-System Socket is designed for under-chassis mounting and requires a 5-1/16-inch hole through the chassis deck. The socket is held in place by the three toe clamps provided. One side of the screen-grid by-pass capacitor is automatically grounded to the chassis when this mounting method is used.

AIR CHIMNEY

The SK-806 Air Chimney is molded of fiberglass-reinforced silicone resin. It effectively directs the flow of air to the anode cooling fins with minimum pressure drop and is recommended for use with each SK-800A when the air-cooled 4CX1000A is to be socketed.

SK-800A:

Net Weight	18 ounces

SK-806:

Net Weight	3¼ ounces
Maximum Height	1⅞ inches
Maximum Diameter	6⅛ inches

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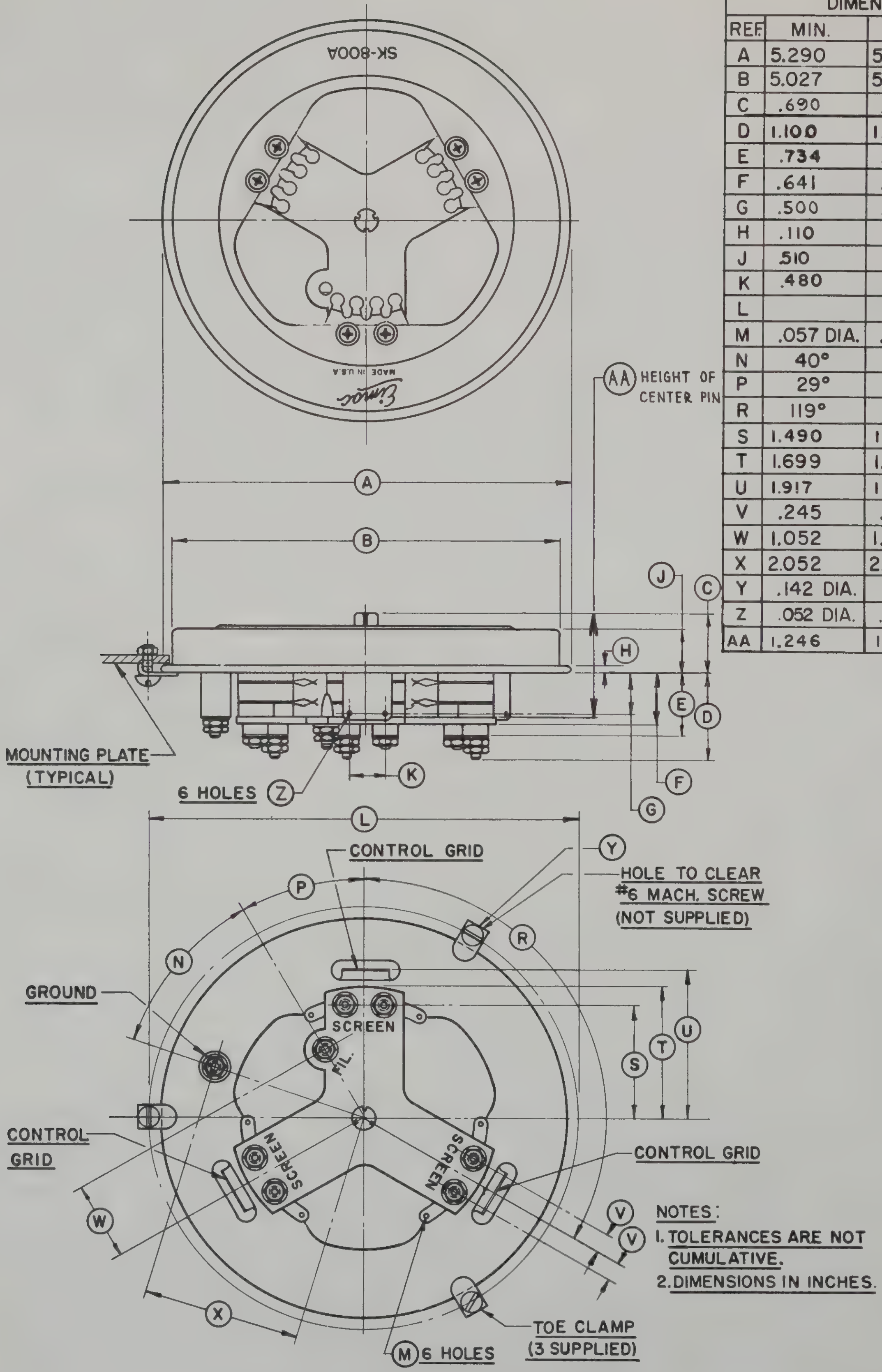
DIMENSION DATA			
REF.	MIN.	MAX.	NOM.
A	5.290	5.330	
B	5.027	5.047	
C	.690	.730	
D	1.100	1.170	
E	.734	.774	
F	.641	.681	
G	.500	.540	
H	.110	.140	
J	.510	.540	
K	.480	.520	
L			5.595
M	.057 DIA.	.077 DIA.	
N	40°	42°	
P	29°	31°	
R	119°	121°	
S	1.490	1.530	
T	1.699	1.739	
U	1.917	1.957	
V	.245	.255	
W	1.052	1.072	
X	2.052	2.072	
Y	.142 DIA.		
Z	.052 DIA.	.072 DIA.	
AA	1.246	1.286	



NOTES:

1. TOLERANCES ARE NOT CUMULATIVE.
2. DIMENSIONS IN INCHES.

EITEL-McCULLOUGH, INC.
SAN CARLOS · CALIFORNIA

SK-810
AIR-SYSTEM SOCKET GROUNDED CATHODE TERMINALS
SK-806
AIR CHIMNEY

The Eimac SK-810 is one of the air-system sockets recommended for use with the Eimac 4CX1000A or 4CW2000A tetrodes. A companion SK-806 Air Chimney is also available and is recommended for use with the socket when the air-cooled 4CX1000A is to be employed.

When this socket is used, connection is made to each of the tube electrodes except the anode, and to one side of the integral screen-grid by-pass capacitor. The SK-810 is humidity and salt-spray resistant.

SK-810

SK-810 WITH CHIMNEY

BASE CONNECTIONS

The SK-810 socket consists of three sets of spring-finger contacts for each tube electrode (to assure low-inductance contact), a center guide pin to facilitate tube installation, and an integral screen by-pass capacitor. The terminals are shown on the outline drawing.

When this socket is mounted on a grounded chassis, the cathode and one side of the heater will be automatically grounded. A grounding terminal is provided and may be used for positive connection if desired.

SCREEN-GRID BY-PASS CAPACITOR

This capacitor utilizes polyester film as a dielectric and is encapsulated in epoxy resin. Its capacitance is 1500 uufds ±20 percent and it is rated at 400 d-c working volts. One side connects to the three screen-grid tabs on the tube and the other side is connected directly to the socket body.

MATERIALS AND FINISHES

The metal shell, or body, of the socket is fabricated of silver-plated brass, while the mounting base and centering pin are of nickel-plated brass. All contacts are formed of a non-ferrous alloy, heat treated and silver plated. Contact insulating material is high-temperature ceramic.

INSTALLATION

The SK-810 Air-System Socket is designed for under-chassis mounting and requires a 5-1/16-inch hole through the chassis deck. The socket is held in place by the three toe clamps provided. One side of the screen-grid by-pass capacitor is automatically grounded to the chassis when this mounting method is used.

AIR CHIMNEY

The SK-806 Air Chimney is molded of fiberglass-reinforced silicone resin. It effectively directs the flow of air to the anode cooling fins with minimum pressure drop and is recommended for use with each SK-810 when the air-cooled 4CX1000A is to be socketed.

SK-810:

Net Weight - 18 ounces

SK-806:

Net Weight - 3¼ ounces
Maximum Height - 1⅞ inches
Maximum Diameter - 6⅝ inches

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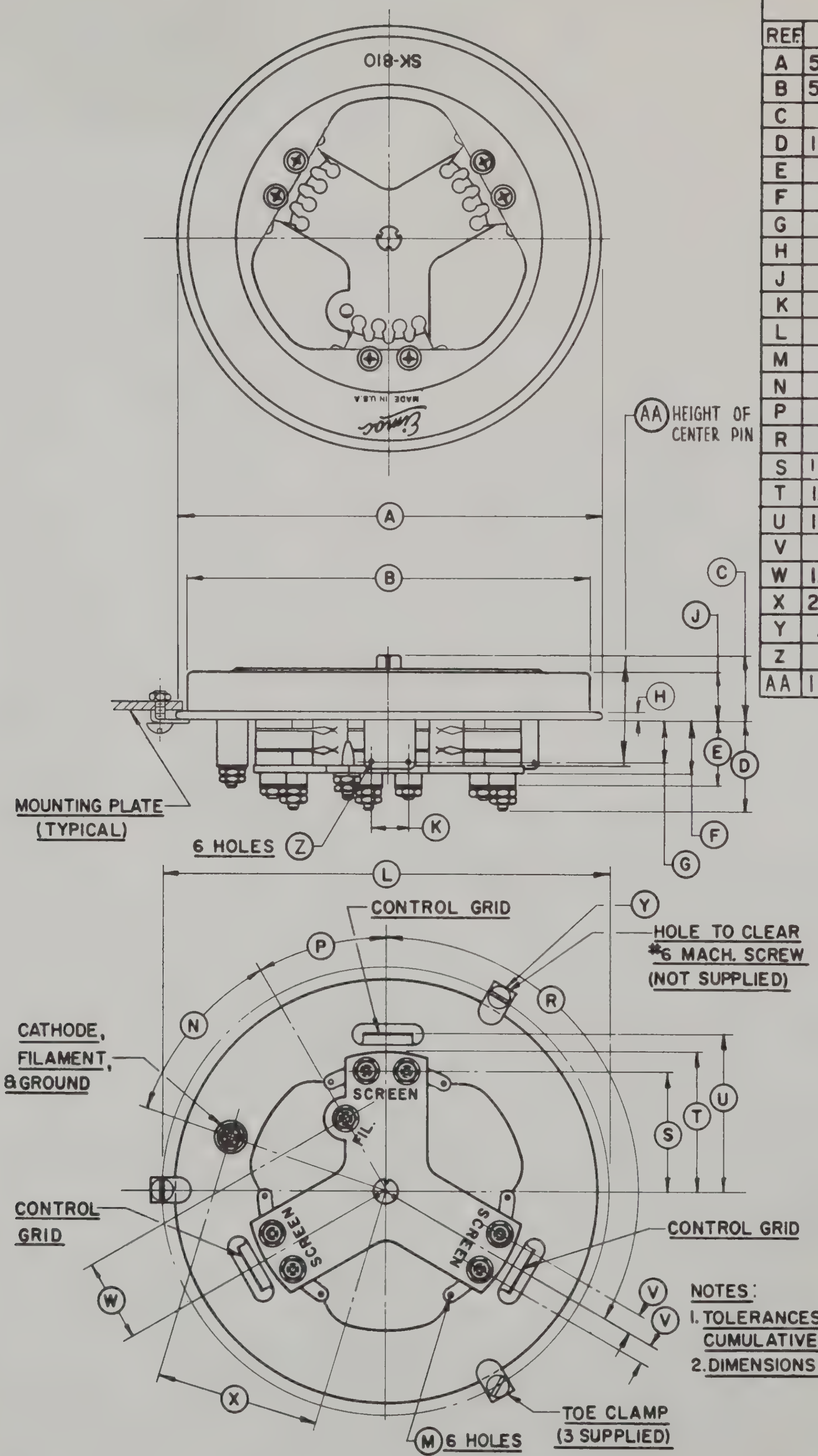
DIMENSION DATA			
REF.	MIN.	MAX.	NOM.
A	5.290	5.330	
B	5.027	5.047	
C	.690	.730	
D	1.100	1.170	
E	.734	.774	
F	.641	.681	
G	.500	.540	
H	.110	.140	
J	.510	.540	
K	.480	.520	
L			5.595
M	.057 DIA.	.077 DIA.	
N	40°	42°	
P	29°	31°	
R	119°	121°	
S	1.490	1.530	
T	1.699	1.739	
U	1.917	1.957	
V	.245	.255	
W	1.052	1.072	
X	2.052	2.072	
Y	.142 DIA.		
Z	.052 DIA.	.072 DIA.	
AA	1.246	1.286	



NOTES:

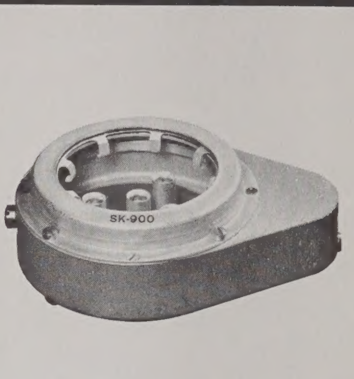
1. TOLERANCES ARE NOT CUMULATIVE.
2. DIMENSIONS IN INCHES.

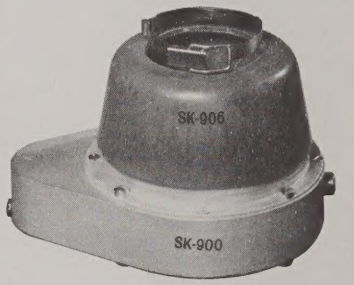
Eimac®

EITEL-McCULLOUGH, INC.
SAN CARLOS · CALIFORNIA

TENTATIVE DATA
SK-900
SOCKET
and
SK-906
CHIMNEY

The Eimac SK-900 Air-System Socket and companion SK-906 Air Chimney are intended for use with the Eimac 4X500A. The socket makes connection to each of the tube electrodes except the anode. A screen-grid by-pass capacitor is incorporated as an integral part of the socket.





BASE CONNECTIONS

Filament, control-grid, and screen-grid pins of the tube are engaged by four self-aligning pin-jacks supported in a disk of low-loss material and terminating in 10-32 studs. The connecting leads to these studs must be sufficiently flexible to allow free movement of the pin-jacks or the self-aligning feature will be impaired. The supporting insulating disk rests on a shoulder turned into the bottom of the socket body and is held in place by four machine screws which act as clamps. This design permits the insulation and terminal assembly to be rotated to any convenient position and clamped firmly in place.

SCREEN-GRID BY-PASS CAPACITOR

This capacitor utilizes polyester film as the dielectric and is encapsulated in epoxy resin. The capacitance is 650 uuf ± 20% and is rated at 700 working volts. One side of the by-pass capacitor contacts the screen-grid flange of the tube through eight spring fingers and the other side is directly connected to the socket body.

INSTALLATION

The SK-900 Air-System Socket is designed for under-chassis mounting and requires a 3 5/8-inch hole through the chassis deck. The socket is held in place by four 8-32 machine screws running through the chassis and into tapped holes in the cast aluminum socket body. One side of the screen-grid by-pass capacitor is automatically grounded to the chassis when this mounting method is used.

An air blower may be connected to the socket air-inlet by means of a duct terminating in a cylindrical fitting of 1 1/4-inch OD or the entire chassis may be pressurized.

Pressure drop across the socket and tube (with SK-906 installed) may be measured by a manometer arranged to indicate the pressure difference between the air in the socket (or pressurized chassis) and the surrounding air. A 1/4-28 tapped hole is provided in the socket body to facilitate the installation of a fitting. A suitable fitting will have a hole diameter of approximately 1/64 inch and when installed, must be flush with the inner wall of the socket to avoid inaccurate pressure measurements.

SK-906 AIR CHIMNEY

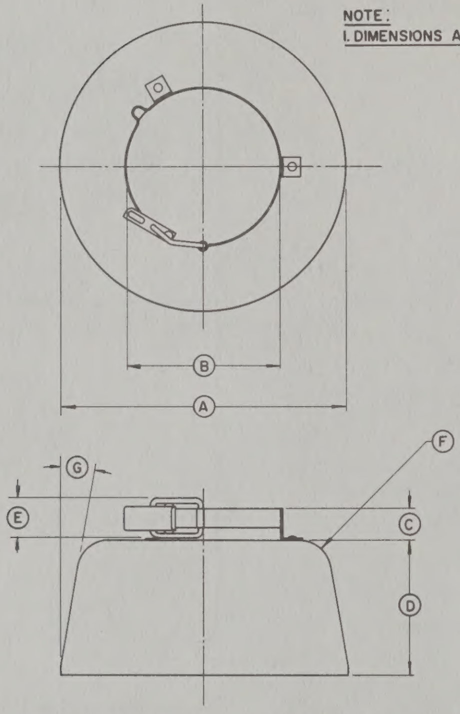
The air chimney is molded of fiber-glass reinforced silicone resin and fitted with an anode clamp. It effectively directs the flow of air to the anode cooling fins with minimum pressure drop and is recommended for use with each SK-900 Air-System Socket.

(Effective 6-1-60) Copyright 1958 by Eitel-McCullough, Inc.

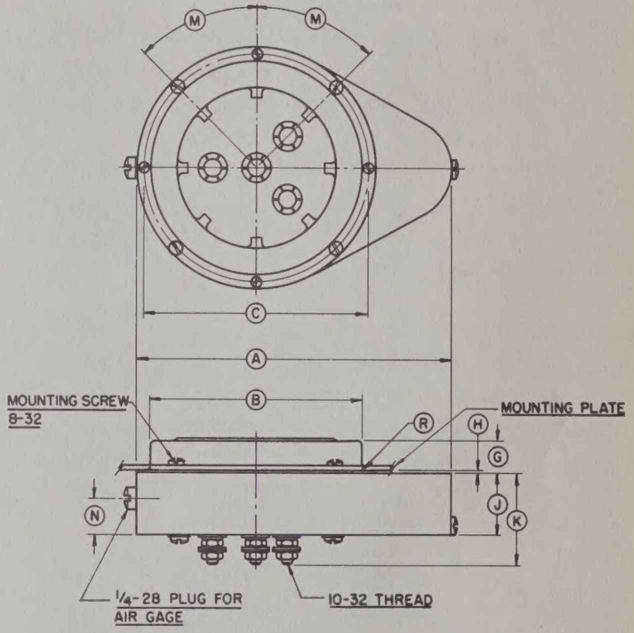
DIMENSION DATA			
REF.	MIN.	MAX.	NOM.
A	3.720 DIA.	3.785 DIA.	
B	1.990 I.D.	2.010 I.D.	
C	3/8	7/16	
D	1.715	1.735	
E	.510	.530	
F			13/32 R.
G	9°	11°	

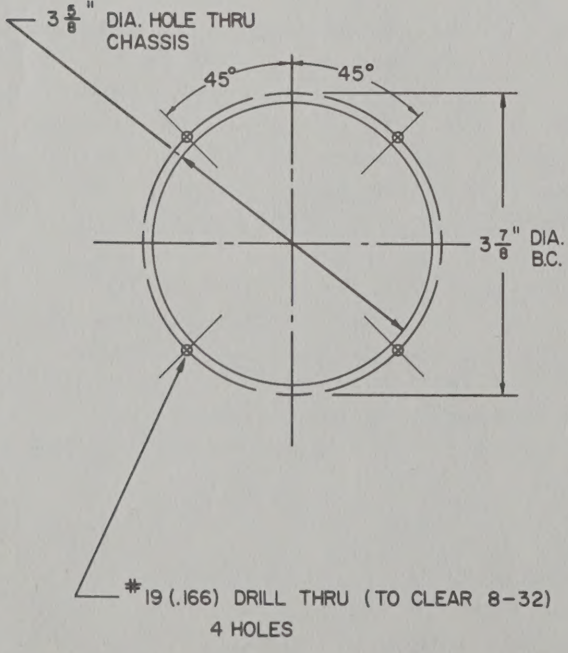
DIMENSION DATA			
REF.	MIN.	MAX.	NOM.
A	5 3/8	5 1/2	
B	3.595 DIA.	3.605 DIA.	
C	3.864 DIA.	3.884 DIA.	
D	4 1/16 DIA.	4 3/16 DIA.	
E	1.490 DIA.	1.510 DIA.	
F	1.248 DIA.	1.263 DIA.	
G	.512	.532	
H	.040	.060	
J	1 3/64	1 5/64	
K	1 33/64	1 37/64	
L	2 15/32 DIA.	2 17/32 DIA.	
M	44°	46°	
N	19/32	21/32	
P	27/32 R.	29/32 R.	
R			.031 R

NOTE:
1. DIMENSIONS ARE IN INCHES.

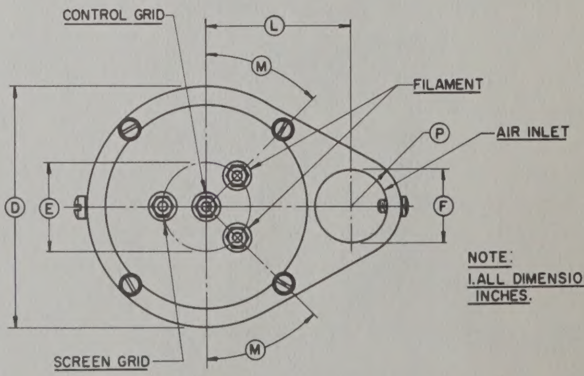


SK-906 CHIMNEY




3 5/8" DIA. HOLE THRU CHASSIS
45°
45°
3 7/8" DIA. B.C.
#19 (.166) DRILL THRU (TO CLEAR 8-32)
4 HOLES

SK-900 CHASSIS DRILLING



NOTE:
1. ALL DIMENSIONS IN INCHES.

SK-900 SOCKET

LA-465

SMITH
CRAFTED
LOS ANGELES